This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

A history of the earth and animated nature

Oliver Goldsmith

KG 12638

Charles F. Möring.
From his Mother, Dec. 24th, 1874.

Harvard College Library
BEQUEATHED BY
MRS. ANNA LOUISA MÖRING,
OF CAMBRIDGE, MASS.

Received Sept. 15, 1890.

Sir Joshua Reynolds
T W Knight

OLIVER GOLDSMITH.

BLACKIE AND SON
GLASGOW, EDINBURGH & LONDON

A HISTORY

OF THE

EARTH AND ANIMATED NATURE

BY

OLIVER GOLDSMITH

WITH NUMEROUS NOTES
FROM THE WORKS OF THE MOST DISTINGUISHED
BRITISH AND FOREIGN NATURALISTS.

VOL. I.

BLACKIE & SON
GLASGOW, EDINBURGH & LONDON.

A HISTORY

OF THE

EARTH AND ANIMATED NATURE.

BY

OLIVER GOLDSMITH.

WITH NUMEROUS NOTES

FROM THE WORKS OF

THE MOST DISTINGUISHED BRITISH AND FOREIGN NATURALISTS.

ILLUSTRATED BY UPWARDS OF TWO THOUSAND FIGURES.

VOLUME I.

Lucem Libris Disseminamus

LONDON:
BLACKIE AND SON, PATERNOSTER ROW;
AND GLASGOW AND EDINBURGH.
MDCCCLXII.

~~V. 3888~~

~~MH 561.1.10~~

KG 12638

15 Sept. 1890,

Bowring Bequest.

1-2

GLASGOW:
W. G. BLACKIE AND CO., PRINTERS,
VILLAFIELD.

PREFACE.

GOLDSMITH'S HISTORY OF THE EARTH AND ANIMATED NATURE was first published in the year 1774 (the year of the author's death), and it doubtless owed its origin to the writings of Buffon, which, about this period, had attracted the eyes of all Europe to the study of Natural History. An English translation of the French naturalist's voluminous productions, with their numerous illustrations, was at first considered by the booksellers as too hazardous a step to venture on; ten years more had to elapse before that undertaking was commenced; but something, it was felt, might meanwhile be done towards producing a native work on the same subject, having similar recommendations as to character, without being equally expensive, and at the same time embracing *the whole* animal kingdom—FISHES and INSECTS, as well as QUADRUPEDS and BIRDS—which Buffon's labours did not pretend to do. This work GOLDSMITH was prevailed upon to undertake, and with what success he accomplished his task, the world, by its unanimous approval, has long decided. He brought, it is true, little original information to the subject, nor did he affect, except in a few cases, to rest the truth of his statements on personal investigation; but he collected, arranged, and combined, into one consistent whole, the knowledge which then existed on Natural History, and, by the graces of his style, threw a charm over the science, unknown before to the English reader. Buffon was confessedly his main guide; and, following him, he was inclined to hold in little estimation the elaborate systematic arrangements of other naturalists—an error on his part, which, after all, is perhaps not much to be regretted, if, by adopting it, he was enabled to render his subject more attractive. The first point to be gained, in his day particularly, was to *excite an interest* in the science, by displaying before the public eye its numberless treasures. This once accomplished, little fear could be entertained but that its study would come to be pursued methodically. To GOLDSMITH, who, in the words of Dr. Johnson, "touched nothing which he did not adorn," belonged the privilege of exhibiting in the golden light of genius a subject which had hitherto in England been only partially or barrenly disclosed; nor should we complain, if to others he left the task of classifying, more rigidly than he at the time saw necessary, those living phenomena of Nature which he had so brilliantly illustrated.

In preparing the present edition, it was at first thought that the Work might be so arranged as to accord with some modern system of classification; but after a short trial, this design was abandoned, not altogether from its impracticability, but from the necessity which it entailed of making more violent changes on the original than was anticipated.

4

These changes, it was found, would not be confined to the mere transposition of chapters, but would interfere in many cases with the integrity of the author's text—a point which no expediency could justify, and which, if once admitted in reprints of standard books, would put an end to all reliance on their fidelity. It was, therefore, resolved to publish the HISTORY OF THE EARTH AND ANIMATED NATURE without transposition or alteration of any kind, but to supply, in the shape of NOTES, whatever was found necessary for the correction or illustration of the text, including descriptions of the different systematic arrangements of the Animal Kingdom adopted by the more distinguished modern naturalists. By this method, the reader would have the satisfaction of possessing, in its entire and unaltered state, the celebrated work of GOLDSMITH, accompanied, at the same time, by a fund of additional matter, which would bring down the history of the subjects treated of to the present day, and introduce the recent important discoveries connected therewith. Following this design, no pains have been spared to render its execution satisfactory. A glance over the volumes will at once show how copiously they are illustrated, in all their departments. The Notes, in short, far surpass in extent of letter-press the text itself. They have been compiled from almost every variety of source, including all the most approved modern publications on Natural Science and History. In most of the editions of GOLDSMITH'S NATURAL HISTORY, the Illustrative Engravings have either been few in number, or exceedingly deficient in truth and artistic quality, or have been both few and bad. The Publishers desired to obviate any such fatal objections to the present edition; and they believe that the Engravings they have introduced, in number, as well as in quality, will give evidence of the attention that has been paid to the illustrative department. These contain nearly TWO THOUSAND FOUR HUNDRED FIGURES, embracing an extensive series of genera, species, and individuals; and of this number, upwards of TWO HUNDRED FIGURES, forming groups of the most interesting families, are truthfully and carefully coloured.

GOLDSMITH'S popular writings are of a class that "the world will not willingly let die;" and it is hoped, that the extensive additions now made to his Natural History, and the pictorial illustrations prepared for it, will render it better suited to the wants of the present day, and will aid in the perpetuation of a Work of which Dr. Johnson prophesied that it would prove "as interesting as a fairy tale."

GLASGOW, 1862.

CONTENTS OF VOLUME FIRST.

These Contents comprise only the Headings of the different Sections, as written by Goldsmith; for the Contents of the Supplementary Notes, the reader is referred to the General Index.

A HISTORY OF THE EARTH.

PAGE
CHAP. I. A Sketch of the Universe . . 1
II. A short Survey of the Globe, from the light of Astronomy and Geography 9
III. A view of the surface of the Earth 11
IV. A review of the different Theories of the Earth 12
V. Of Fossil-shells, and other extraneous Fossils 17
VI. Of the Earth's internal structure 23
VII. Of Caves and Subterraneous Passages that sink, but not perpendicularly, into the earth . . 32
VIII. Of Mines, Damps, and Mineral Vapours 35
IX. Of Volcanoes and Earthquakes 40
X. Of Earthquakes 46
XI. Of the appearance of new Islands and Tracts, and of the disappearing of others 52
XII. Of Mountains 57
XIII. Of Water 65
XIV. Of the origin of Rivers . . . 73
XV. Of the Ocean in general; and of its saltness 83
XVI. Of the Tides, motion, and currents of the Sea; with their effects . 89
XVII. Of the changes produced by the Sea upon the Earth 96
XVIII. A summary account of the mechanical properties of Air . . 104
XIX. An essay towards a natural history of the Air 108
PAGE
CH. XX. Of Winds, regular and irregular . 116
XXI. Of Meteors and such appearances as result from a combination of the Elements 128
XXII. The Conclusion 144

A HISTORY OF ANIMALS.

CHAP. I. A Comparison of Animals with the inferior ranks of Creation . . 146
II. Of the Generation of Animals . 150
III. The Infancy of Man 160
IV. Of Puberty 165
V. The Age of Manhood . . . 167
VI. Of Sleep and Hunger . . 183
VII. Of Seeing 191
VIII. Of Hearing 195
IX. Of Smelling, Feeling, and Tasting 200
X. Of Old Age and Death . . 204
XI. Of the varieties in the Human Race 209
XII. Of Monsters 218
XIII. Of Mummies, Wax-work, &c. . 224
XIV. Of Animals 229
XV. Of Quadrupeds in general, compared to Man 235

BOOK I.

ANIMALS OF THE HORSE KIND.

CHAP. I. Of the Horse 245
II. Of the Ass 258
III. Of the Zebra 264

BOOK II.

OF RUMINATING ANIMALS.

PAGE
CHAP. I. Introduction 268
II. Of Quadrupeds of the Cow kind 269
The Buffalo 281
III. Of Animals of the Sheep and Goat kind 286
The Sheep 287
The Goat and its numerous varieties 299
Animals of the Antelope kind . 304
The Gazelle 307
IV. Of the Musk Animal . . . 315
V. Animals of the Deer kind . . 318
The Stag 319
The Fallow-deer 328
The Roe-buck 330
The Elk 332
The Rein-deer 335

BOOK III.

QUADRUPEDS OF THE HOG KIND.

CHAP. I. Introduction 342
The Wild Boar . . . . ib.
The Hog 344
II. The Peccary, or Tajacu . . 347
III. The Capibara, or Cabiai . . 350
IV. The Babyroussa or Indian Hog . 351

BOOK IV.

CARNIVOROUS ANIMALS.

CHAP. I. Animals of the Cat kind . . 353
The Lion 360
The Tiger 369
The Panther 376
The Leopard . . . . . ib.
The Lynx 379
The Siagush 381
II. Animals of the Dog kind . . 384
The Dog . . . . . . ib.
The Wolf 398
The Fox 403
The Jackal 406
The Isatis 408
The Hyæna . . . . . ib.
PAGE
CH. III. Animals of the Weasel kind . . 410
The Weasel . . . . . ib.
The Ermine or Stoat . . . 413
The Ferret 414
The Polecat 415
The Martin 417
The Sable 418
The Ichneumon 419
The Stinkard 420
The Genet 422
The Civet 423
The Glutton 424

BOOK V.

ANIMALS OF THE HARE KIND.

The Hare 428
The Rabbit 434
The Squirrel 436
The Flying Squirrel . . . 440
The Marmout 441
The Agouti 444
The Paca 445
The Guinea Pig 446

BOOK VI.

ANIMALS OF THE RAT, HEDGEHOG, &c., KINDS.

CHAP. I. The Great Rat 448
The Mouse 451
The Dormouse 453
The Musk Rat. . . . . ib.
The Cricetus 454
The Leming 456
The Mole 457
II. The Hedgehog 462
The Tanrec, Tendrac . . . 464
The Porcupine . . . . ib.
III. Of Quadrupeds covered with Scales or Shells, instead of Hair . . 467
The Pangolin 468
The Armadillo, or Tatou . . 469
IV. Animals of the Bat kind . . 471
The Bat . . . . . . ib.
V. Of Amphibious Quadrupeds . 474
The Otter 475
The Beaver 477
The Seal 481
The Morse 487
The Manati . . . . . ib.

BOOK VII.

ANIMALS OF THE MONKEY KIND—THE ELEPHANT, RHINOCEROS, &c., &c.

PAGE
CHAP. I. Animals of the Monkey kind . 489
The Orang-outang 491
The Baboon 499
The Monkey 501
The Maki 509
The Opossum, and its kinds . 511
II. Of the Elephant 515
III. Of the Rhinoceros 529
CH. IV. Of the Hippopotamus . 532
V. The Camelopard or Giraffe . 534
VI. The Camel and the Dromedary . 535
VII. The Llama 540
VIII. The Nyl-ghau 543
IX. The Bear 544
X. The Badger 551
XI. The Tapir 552
XII. The Racoon 554
XIII. The Coatimondi 555
XIV. The Ant Bear . . . . . ib.
XV. The Sloth 557
XVI. The Jerboa 559
Concluding remarks 561

ON THE

CLASSIFICATION OF ANIMALS;

WITH

AN ACCOUNT OF THE SCIENTIFIC LABOURS OF BARON CUVIER.

Although it cannot be doubted that the attention of men was early attracted to an observation of the habits and natures of animals, Aristotle seems to have been the first who furnished the world with any methodical information on this subject. His work Πεϱι Ζωων Ιστοϱιαι contains a great number of facts and observations. He compares the organization of the lower animals, in its different parts, with that of man, and treats of their mode of generation, habits, organs, &c., with great clearness and sagacity; and his principal divisions of the animal kingdom are so well founded that almost all of them are still substantially admitted. Among the Romans, zoology does not appear to have been at all cultivated, until the time of Pliny, who is the only Roman zoologist worthy of notice. His work (*Historia Naturalis*) contains multitudes of original traits though it is only a compilation, and describes the habits and dispositions of animals with great felicity. He adopted, without examination, many fabulous stories, and too often neglected important details. Ælian was far inferior to the two above-mentioned writers, and his Natural History of Animals may be considered as the source of all the falsehood and error which so long disgraced this branch of natural history. Apuleius, and Athenæus the grammarian, are the only names that deserve mention, from the time of Ælian and Pliny to the beginning of the sixteenth century; and they added nothing to the stock of zoological science. At the latter period, flourished, among others, Belon, a French physician, who made the closest approach of any author of that time to any thing like systematic classification, in his *De Aquatilibus*, and particularly in his *De la Nature des Oiseaux* (Paris, 1555, folio); Salviani, author of a treatise, *Aquatilium Animalium Historia* (Rome, 1554, folio), which is superbly illustrated; Conrad Gesner, whose *Historia Animalium* (Zürich, 1550—1587, 4 vols. folio), arranged in alphabetical order, forms the foundation of modern zoology; and Aldovrandus, the most laborious of compilers, who devoted sixty years to his work on natural history, in fourteen volumes, folio, of which the greater part was published after his death. These earlier writers were followed, in the next century, by Redi and Swammerdam, to whom entomology is so much indebted, and by Ray, the first naturalist, from the time of Aristotle, who produced any thing like a scientific arrangement. The works of Ray, under his own name, are *Synopsis Quadrupedum et Serpentum* (1683, 8vo.); *Synopsis Avium et Piscium* (1713); and *Historia Insectorum;* and he is also considered to have had a large share in the compositions of his pupil Willoughby. But it was reserved for Linnæus to raise natural history to the rank of a science. Gifted with extraordinary powers of invention and discrimination, a most retentive memory, an unrelaxing industry, and the most ardent zeal in the cause of science, this great man observed, with the acutest sagacity, the subtilest affinities of organized nature. The general character of his works is order, precision, clearness, exactness of description, and an accurate knowledge of relations in detail. Buffon adorned natural history with the charms of eloquence, and was the first who extended its popularity beyond mere scholars and men of science. He was occasionally carried by the force of his imagination, into unfounded hypotheses; yet he had a truly philosophical spirit, could observe facts, and compare results, and possessed extensive information. The four great naturalists whom we have had occasion to mention, have exhibited nature under different aspects. Aristotle has shown us the profound combination of its laws; Pliny its inexhaustible riches; Linnæus its wonderful details; and Buffon its majesty and power. Since the time of Buffon, all the departments of zoology have been cultivated with a zeal, a minute accuracy, and an extensiveness of research, before unequalled. Our limits will not allow us to mention all those who have distinguished themselves in the cultivation of the whole field of the science, much less those who, confining themselves to particular branches of it, have yet rendered most important services by the exactness of their researches and the novelty of their views. Among the Germans, Illiger and Blumenbach hold the first rank as zoologists; but it is to France that we are chiefly indebted for the strong impulse which has been given, in our times, to the progress of natural science, and of zoology in particular. The name alone of Cuvier, sufficiently indicates the brilliant triumphs of natural history in that country.

The immense number of facts embraced by natural history could never be retained in the memory without an arrangement of divisions and subdivisions, founded upon some distinguishing characteristics. Aristotle's system of arrangement was simple, resting on divisions derived mainly from the external structure, food, habits and locality. But though neither human nor comparative anatomy was then sufficiently cultivated to enable him to make the internal structure of animals the basis of his divisions, yet Aristotle was not insensible to the advantages of a more scientific distribution, and, with his usual sagacity, recommends to succeeding writers to turn their attention in that direction. Ray followed the advice of the great master, and remarked the great distinction, that some animals possessed lungs and a sanguineous system, while others were destitute of both. Linnæus, proceeding on the general arrangement of Ray, but with many extensions and improvements, divided the animal kingdom into six classes, founded mainly on the differences in the respiratory and sanguineous systems.

Class I.—*Mammalia.* All suckle their young; the heart has two auricles and two ventricles; blood red and warm; viviparous.

Class II. *Aves* (Birds). Characters of sanguineous system as in first class; oviparous.

Class III. *Amphibia.* Heart one auricle and one ventricle; blood red and cold; respiration voluntary.

Class IV. *Pisces* (Fishes). Heart and blood as in *amphibia;* respiration by gills.

Class V. *Insecta.* Heart one ventricle and no auricle; sanies cold, colourless; antennæ, or feelers.

Class VI. *Vermes* (Worms). Characters as in V., except no antennæ, but tentacula.

He then subdivides the *Mammalia* into seven orders, the distinctions of which are taken from the difference in the number, form and situation of the teeth, without, however, neglecting the feet.

Order 1. *Primates.* Four incisors in each jaw, and one canine.—Genera: *homo, simia, lemur, vespertilio.*

Order 2. *Bruta.* No incisors.—Genera: *rhinoceros, elephas, trichechus, bradypus, myrmecophaga, manis, dasypus.*

Order 3. *Feræ.* Six conical incisors in each jaw, for the most part.—Genera: *phoca, canis, felis, viverra, mustela, ursus, didelphis, talpa, sorex, erinaceus.*

Order 4. *Glires.* Two incisors in each jaw; no canines.—Genera: *hystrix, lepus, castor, mus, sciurus, myoxus, cavia, arctomys, dipus, hyrax.*

Order 5. *Pecora.* No fore-teeth in the upper jaw; six or eight in the under.—Genera: *camelus, moschus, giraffa, cervus, antilope, capra, ovis, bos.*

Order 6. *Belluæ.* Obtuse fore-teeth in each jaw.—Genera: *equus, hippopotamus, sus, tapir.*

Order 7. *Cete.* No uniform character of teeth; aquatic pectoral fins; spiracula.—Genera: *monodon, balæna, physeter, delphinus.*

The other classes are subdivided in a similar manner. We shall enumerate only the orders. The distinctions of the *Aves* are taken chiefly from the beak; but the tongue, nostrils, feet, and other parts, are sometimes called in.

Order 1. Accipitres.—2. Picæ.—3. Anseres.—4. Grallæ.—5. Gallinæ.—6. Passeres. (See *Ornithology*).

The *Amphibia* are divided into two orders.

Order 1. *Reptilia.* Furnished with feet, and breathing through the mouth. See *Reptiles.*

Order 2. *Serpentes.* Destitute of feet, and breathing through the mouth. See *Serpents.*

The fourth class, *Pisces,* is subdivided into six orders, the characters of which are taken from the belly-fins.

Order 1. *Apodes.* No ventral fins; embraces the eel kind, torpedo, &c.

Order 2. *Jugulares.* Ventral fins placed before the pectoral; cod, blenny, &c.

Order 3. *Thoracici.* Ventral fins under the pectoral; sucking-fish, goby, plaice, doree, &c.

Order 4. *Abdominales.* Ventral fins placed behind the pectoral; skate, salmon, pike, &c.

Order 5. *Branchiostegi.* Gills destitute of long rays; sun-fish, pipe-fish, &c.

Order 6. *Chondropterygii.* Cartilaginous gills; lamprey, ray, shark, &c.

The fifth class, that of *Insects,* is divided into seven orders, the characters of which are mostly taken from the differences observed in the number and texture of the wings.

Order 1. Coleoptera.—2. Hemiptera.—3. Lepidoptera.—4. Neuroptera.—5. Hymenoptera.—6. Diptera.—7. Aptera.

The sixth class, *Vermes,* is subdivided into five orders.

Order 1. Intestina.—2. Mollusca.—3. Testacea.—4. Zoophyta.—5. Infusoria.

The arrangement of Linnæus, with all its advantages, had its defects. By confining himself too much to one kind of character, he often throws together subjects widely remote in their general appearance and economy; but he has carried the art of distribution, and the management of characters, to such a degree of clearness and brevity, that any person familiarized to his language may easily find the name and place of any being he wishes to observe. It still remained a desideratum to arrange the facts, of which the science treats, in a series of propositions, so graduated and successively subordinate, that the whole might represent the actual relations of living beings. For this purpose, it was necessary to group animals according to their different properties or organizations, so that those contained in such a group should bear a stronger natural resemblance to each other than to any individual of a different group. This arrangement is termed the *natural* method, for the formation of which zoology offers great facilities. In the arrangement of Cuvier, the completest and most scientific yet presented to the world, the great division of the animal world rests on the nervous and sensorial, and not on the circulatory and respiratory, systems. From the study of the physiology of the natural classes of vertebrated animals, Cuvier discovered the respective quantity of respiration, the reason of the quantity or degree of motion, and, consequently, the peculiar nature of that motion. This last gives rise to the peculiar form of their skeletons and muscles; and with it, the energy of their sensations, and the force of their digestion, are in a necessary relation. Thus zoological arrangement, which had hitherto rested on observation alone, assumed a truly scientific form. Calling in the aid of comparative anatomy, it involves propositions applicable to new cases, and thus becomes a means of discovery as well as a register of facts; and, by correct reasoning, founded on copious induction, it partakes of the demonstration of mathematics, and the certainty of experimental knowledge. Having examined the modifications which take place in the organs of circulation, respiration and sensation in the invertebrated animals (a title first given by Lamarck, instead of the erroneous one of *white-blooded* animals, by which they were previously distinguished), Cuvier formed a new division, in which these animals are arranged according to their actual relations.

In attempting to give a sketch of the scientific labours of M. Cuvier, we shall follow the chronological order of his numerous writings, that we may be enabled to trace the progress of zoological discovery during the last fifty years, at the same time that we examine the merits of the successive changes this distinguished naturalist introduced into the science. His labours have been a principal means of the rapid advancement of the study of animated nature in our times. His comprehensive genius shed its lustre over every department of this vast field of inquiry; the existing races of the animal kingdom he reviewed, classified, and defined; their diversified structures he examined and described; and numerous tribes of the extinct species were almost recalled to life by his skill and perseverance.

George Cuvier was born in the year 1769, at Montbeliard, a town now in the department of France, called the Upper Rhine, but which, at the period of his birth, belonged to Wurtemberg, one of the states of Germany. His father was an officer in a Swiss regiment in the service of France, and Chevalier of the Order of Military Merit; he retired after forty years' service, with a moderate pension from France, and some time after he was made commandant of artillery at Montbeliard. Cuvier received the early part of his education at the university of Stuttgard, the capital of Würtemberg, where he resided for several years, directing his attention to the study of mathematics, philosophy, law, and jurisprudence, with the view of qualifying himself for taking a share in the administration of his native country, to which he was induced to look forward by the kind patronage shown him by the late Duke Charles, grand uncle of the king of Würtemberg. These early prospects of Cuvier, however, were soon blasted by the events which agitated France towards the close of the last century, and by which his native country became a part of a French province. The grand displays of natural scenery in the mountainous country around Stuttgard, form an allurement to the study of natural history; and there have long existed both museums and societies in that capital devoted to its advancement. On leaving the university of Stuttgard, Cuvier betook himself to France, where he resided for some time on the coast of Normandy, and afterwards resorted to Paris. Here he commenced his career as a private lecturer, and was soon appointed to assist Professor Mertrud, in the course of comparative anatomy delivered in the Museum of Natural History. Cuvier had already made himself favourably known to several of the most eminent naturalists of Paris, by his new and interesting observations on the structure of molluscous animals, made while residing on the coast of France, as tutor in the family of a nobleman. His zeal and abilities were soon recognized; he was admitted a member of most of the learned societies of Paris, and before the age of twenty-nine he was appointed professor of Natural history in the Central School of the Pantheon. His election as a member of the Institute of France, on the first organization of that assembly in 1796, gave a new impulse to his exertions; and the numerous memoirs and discoveries which he laid before that learned body in the early part of his career, greatly extended his reputation, while they formed the bases of his more enlarged succeeding publications. The structure of the animal frame, in all the modifications it presents throughout the lower classes, was always the favourite subject of his pursuits; and he continued to discharge the duties of professor of comparative anatomy in the Garden of Plants to a late period, notwithstanding the multiplicity of his other avocations. The drawings which accompanied his numerous anatomical memoirs were all executed by himself, and the beauty and elegance of his delineations are not less remarkable than the minuteness and accuracy of his descriptions. Most of these memoirs are published in the Annales du Museum.

The labours of Daubenton, Mertrud, and Rousseau had already greatly extended the Museum of comparative anatomy before the task of completing it fell to M. Cuvier, by his appointment to that chair in the Garden of Plants. While he was professor of natural history in the Pantheon, and delivered lectures on comparative anatomy, for Mertrud, in the Garden of Plants, he published his first separate work, the "Tableau Elementaire," in 1798. This work forms an octavo volume of 710 pages; it presented a new distribution of the whole animal kingdom, and it formed the basis of the two succeeding editions of the Règne Animal. The principles of classification, adopted in this early publication, had already been partly developed by him in a separate memoir on a new division of white-blooded animals, which he published at the age of twenty-six, three years before the appearance of the Tableau Elementaire. In that early memoir, which was read to the Natural History Society of Paris on the 10th of May, 1795, and printed in the Décade Philosophique, Cuvier first attacked Linnæus's division of the invertebrata into insects and worms, and assigned the characters and limits of the new classes mollusca, crustacea, insecta, vermes, echinodermata and zoophyta. The distribution of these invertebrate classes into three great divisions equal to the vertebrata, was afterwards established by Cuvier in a memoir read to the Institute in July, 1812. The classification of animals is one of the principal objects to which the researches both of the zoologist and comparative anatomist are directed: without the assistance derived from methodical arrangement, the multitude and variety of objects belonging to the animal kingdom would continually impede our investigations, and overpower the strongest mind. The efforts of M. Cuvier were, therefore, early directed to this important point; and the publication just mentioned is an outline of the course of lectures delivered by him at the Pantheon, on this subject, in 1797. The animal kingdom is there divided into eight great classes: four of vertebrate animals, *Mammalia*, *Aves*, *Reptilia*, *Pisces;* and four of invertebrate animals, *Mollusca*, *Insecta*, *Vermes*, *Zoophyta;* the orders, genera, and many of the species of which are illustrated by ample details, and the characters of all the different groups are illustrated by fourteen plates, from his own pencil, representing more than a hundred objects.

After some interesting observations on the utility of the study of zoology, and its applications to other sciences, he details the properties which distinguish organized and sentient beings, and gives an outline of the organization of the human body and the distinctions among the different races of mankind. In treating of the mammalia he has somewhat improved the classification of Professor Storr of Tubingen; he adopted the nomenclature of Linnæus, but he greatly improved the characters of the genera and species, by introducing more precise and detailed descriptions of the teeth, taken from the skeletons preserved in the National Museum. The arrangement of the class of birds was taken from Linnæus and Buffon, and the descriptions are short and perspicuous. The class of reptiles is divided into two orders, oviparous quadrupeds, and serpents; the former comprehending the *chelonia*, *sauria*, and *batrachia* of Brogniart and the later editions of the Règne Animal, and the latter order comprehending the *ophidia*. The divisions of the class of fishes are adopted from Linnæus; they consist of six orders, founded on the position of the fins, and Blumenbach had previously copied the same arrangement into his "Manual of Natural History." The cartilaginous fishes, which are placed first in the work of Blumenbach, and in the Tableau Elementaire, the Leçons d'Anatomie Comparée, and likewise in the Règne Animal of 1817, were properly thrown to the bottom of the class in the great work on the Natural History of Fishes, (1828), and in the new edition of the Règne Animal (1829), as in their skeleton and other parts of their organization they approach to the molluscous animals. The whole of the invertebrate animals are distributed into three great groups, which correspond with the mollusca, articulata, and zoophyta of the Règne Animal. The animals of the first division, mollusca, are characterized as having a muscular heart, and no longitudinal, knotted, nervous cord; those of the second division, insects and worms, have a longitudinal dorsal vessel, and a knotted spinal cord, or at least one of these two characters; those of the third division, zoophyta, have neither heart, nor brain, nor nerves. The mollusca are divided into the cephalopoda, gasteropoda nuda, gasteropoda testacea, and acephala; the last of these divisions comprehending Lamarck's classes, conchifera, tunicata, and cirrhipeda. His next great division he terms insects and worms, and comprehends under it all the crustacea, arachnida, insecta, annelida, and entozoa of later authors. The arrangement of these is taken chiefly from Linnæus and Fabricius, and he was as fortunate in having the personal assistance of Fabricius in regard to this class, as he had been in obtaining that of Lacepede for the classes of reptiles and fishes, and that of Lamarck for the testaceous mollusca and the corals. Cuvier, however, paid a minuter attention to the organs of manducation of insects in this work than had been done by his predecessors, and pointed out many important characters founded on these parts. The division of his great group zoophyta is nearly the same as that of the Règne Animal, with the exception of the entozoa, being placed among the vermes in the Tableau Elementaire, and the infusoria being placed between the acephala and the true ramified zoophytes which terminate the volume.

From the wide range of M. Cuvier's investigations and public duties, he was often obliged to pass from the beaten path of his predecessors in treating of the anatomy of animals, and to travel over ground which had been but little explored. The tracks pointed out by Pallas, Camper, Vicq-d'Azir, and Daubenton, were too common to engage his attention; and he found, in the obscure paths followed by Swammerdam, Lister, Basterus, and Réaumur, materials more calculated to extend the principles of physiology, to enlarge the views of the anatomist, and to advance the science of zoology, than by confining his inquiries to the vertebrate classes. By his interesting researches regarding the mollusca, while residing in the south of France, he became known to Lametherie, Tessier, Olivier, Lacepede, Geoffroy, and Millin, who invited him to come to Paris, and obtained for him the chair of zoology in the Pantheon. His earliest anatomical memoirs read before the Institute of France, were on animals the most remote from man. His memoir on the Medusæ pointed out, in animals two feet in diameter, a structure nearly as simple as that of the Infusoria. The numerous memoirs which he published in the Annales du Museum on the anatomy of molluscous animals, fill alone a quarto volume of nearly 500 pages: they contain descriptions of the structure of nearly fifty genera, and are illustrated by thirty-five elaborate plates from his own pencil. These memoirs rectified many of the errors or supplied the deficiencies of preceding observers, and cast a new light on the most remarkable and unknown forms of organization; they pointed out the true relations of these diversified beings to each other; and, by affording the means of dividing them into natural and closely allied groups, they greatly facilitated the labours of the conchologist. He minutely detailed the anatomy of most of the known cephalopodous and pteropodous mollusca, and of numerous genera of naked and testaceous gasteropoda. His memoirs on the ascidia and other acephalous mollusca were the means of illustrating the whole class of tunicated animals; his memoir on the cirrhipeda established the true relations of these singular animals, in pointing out their numerous affinities with other articulated animals in their nervous system, their respiratory organs, and their articulated extremities; and his concluding dissertation on the species of crustacea known to the ancients, displays a happy union of extensive zoological knowledge with profound classical erudition.

A career of original investigation, like that of M. Cuvier, ill accords with the patience and labour required in extensive compilations; and although an elementary work on his favourite subject of comparative anatomy, was still a desideratum in France, he was too much impressed with the difficulty of the undertaking, and too eagerly engaged in a new train of investigation, to undertake the composition of such a work. Fortunately for the science, M. Cuvier found two able anatomists eager and qualified to reduce, to the form of a system, the vast materials employed by him in his courses of lectures on comparative anatomy. M. Mertrud had been appointed to the newly created chair of comparative anatomy in the Garden of Plants, but from his advanced age at that time, he was induced, by the advice of his colleagues, to appoint Cuvier as his substitute, and in that capacity Cuvier devoted himself to the extension of the Zootomical Museum, and to the means of illustrating his lectures, which were then attended by numerous assemblies. On the death of Mertrud, who had been long assistant to Daubenton, Cuvier succeeded him as professor of comparative anatomy on the 1st of November, 1802. M. Dumeril, who accomplished the two first volumes of the Leçons d'Anatomie Comparée, comprehending the Organs of Motion and those of Sensation, was then at the head of the anatomical department of the School of Medicine at Paris; and the composer of the three last volumes, treating chiefly of the organs of digestion, circulation, respiration, secretion, and generation, was Dr Duvernoy, a relation of M. Cuvier, a young and zealous anatomist, afterwards professor of natural history at Strasburg. M. Cuvier's attention was at this time directed to the excavations in the gypsum strata of Montmartre; and his frequent excursions to that interesting theatre of geological events, together with the labour of comparing the accumulations of bones daily extracted from the quarries with those of the skeletons preserved in the cabinet, must have considerably distracted his attention from the compilation of the Leçons d'Anatomie Comparée, and left a large share of the merit of these volumes to the skilful anatomists who conducted them. The first volume of the work is prefaced by a letter of twenty-two pages from Cuvier to his zealous preceptor, Professor Mertrud; in which he explains, with his usual eloquence and perspicuity, the nature of the subject, the particular scope of the work, and the manner in which it was got up, from his oral demonstrations. The work is in five octavo volumes, of about 500 pages each; it is illustrated by fifty-two engraved plates; and still forms the most perspicuous, correct, and complete systematic view of the science which exists in any language. In collecting materials for the work, Cuvier was aided by many donations of specimens from his friends and correspondents in distant parts; he had liberty to dissect all the animals which died in the Menagerie, and even to open those rare species which had long been preserved in the museum in spirits. Cuvier and his pupils dissected, in 1802, the large male elephant which had been pillaged, along with many other zoological treasures, from the Statholder in Holland, during the revolution; he dissected another male elephant in 1804, and a female elephant a few years afterwards. His younger brother, M. Frederick Cuvier, was appointed keeper of the Menagerie in 1805, and rendered Cuvier great assistance in completing the series of skeletons of the museum of comparative anatomy, which was first opened to public inspection in 1806. Manuscript copies of M. Cuvier's lectures on comparative anatomy, taken by pupils from his oral demonstrations, had been circulated in Paris, and even cited in works, before he undertook to publish them in a complete and connected form; and M. Dumeril had taken regular and ample notes from these demonstrations during four successive years.

A period of five years elapsed between the publication of the first two volumes of the Leçons and the succeeding three; during which time M. Cuvier was elected perpetual secretary of the French Institute. He was secretary of the Institute so early as 1800, when that office was only temporary and of two years' duration; he had been the third elected since the beginning of the Institute. At this time Napoleon, returned from Egypt and declared first consul, was made president of the Institute, which brought Cuvier into frequent personal intercourse with his future sovereign. In 1802 Napoleon, desiring to reorganize the schools of France, appointed six general inspectors to establish lyceums in thirty cities of the empire. Cuvier was made one, and in that capacity he established the first lyceums (now royal colleges) of Marseilles and Bourdeaux. It was while absent from Paris, on this embassy, that the secretaries of the Institute were made perpetual, and Cuvier was appointed to that of the physical sciences. When at Marseilles he availed himself of the favourable opportunity to extend his inquiries into the structure of the mollusca. The numerous avocations both of M. Dumeril and M. Cuvier prevented them from devoting the time and attention to the concluding volumes which they had devoted to the preceding; and Dr Duvernoy, though aided by the manuscript notes of the former, and the plates, preparations, descriptions, and regular revisal of the latter, had many dissections to perform and repeat, and many deficiencies to supply in his difficult and meritorious task of completing the work. Cuvier had opportunities of dissecting many rare and unknown animals while the later volumes of the comparative anatomy were preparing, partly from the menageries of the Garden of Plants and of Malmaison, and partly brought from a distance in spirits, by Geoffroy and Savigny from Egypt, by Peron from Australasia, by Humboldt from America, by Homberg and Fleuriau from the coasts of France, and by Cuvier himself from the Mediterranean In his interesting letter to Lacepede, professor of zoology in the museum of natural history, inserted at the beginning of the third volume, he details briefly the progress of comparative anatomy during the five preceding years, and the important influence which his own researches for fifteen years had exerted in reforming the methodical arrangements of zoologists; the absurd classifications of the Linnæan school, founded solely on external form or on a single character, and the necessary dependance of correct zoological arrangements on the progress and application of zootomical knowledge, are also pointed out with great distinctness and ability.

The organs of digestion form the subject of the third volume; and, in treating of this function, many important parts of the system are described with great minuteness and detail. The form, structure, and motions of the jaws; the teeth of mammalia, reptiles, and fishes; the salivary glands, the organs of mastication and deglutition; the structure and peculiarities of the œsophagus, stomach, and intestinal canal, throughout the various classes of animals, are successively described, and in every part illustrated with original observations. The peculiarities of the liver, pancreas, and spleen, and the digestive apparatus of invertebrate animals, form the first subjects of the fourth volume; the heart and circulating organs, the organs of respiration in land and aquatic animals, and the organs of voice, so intimately connected with atmospheric respiration, are described at great length in the same volume. The organs of generation and those of excretion occupy the fifth volume. Throughout these volumes, the parts which relate to the organization of insects and molluscous animals are the exclusive productions of M. Cuvier; and, probably, no anatomist then living, besides himself, was qualified to undertake these obscure parts of zootomy. In what relates to the digestive system of the mammalia, nearly all the interesting facts collected by Daubenton, in his description of the cabinet, have been incorporated. In the tables of the classification of the whole animal kingdom, added to this work, many important improvements are introduced into the arrangements of the Tableau Elementaire; partly resulting from M. Cuvier's own more extended inquiries, and partly adopted from the eminent writers who, during this period, had illustrated many separate branches of zoology. In what relates to the classification of quadrupeds and birds, he availed himself of the improvements introduced by Lacepede, and in the arrangement of the testaceous mollusca, he was assisted by the labours of Lamarck. The vermes and crustacea here form two classes distinct from that of insects; the former arrangement of reptiles, taken from Lacepede, is changed for the more convenient subdivisions of Brogniart, into chelonia, sauria, ophidia, and batrachia. The entozoa are placed, provisionally, in the class of vermes; and the infusoria still succeed the medusæ in the class of zoophytes.

During the composition of the Leçons, M. Cuvier collected many interesting observations regarding the fossil bones accumulated in the strata around Paris. In his visit to Italy he examined the situations most famed for the fossil remains of animals they afforded, and many distinguished naturalists sent him from distant parts of Europe remains, or drawings or descriptions, of animals found in a fossil state. The immense collection of skeletons preserved in the Cabinet of Comparative Anatomy at Paris, afforded him the means of instituting the necessary comparisons of the fossil with the existing species, and must have greatly assisted and encouraged him in his early attempts to decipher the remains of the higher classes of animals so frequently submitted to his inspection. The certainty of the truths thus brought to light, the novelty of the results, and their important applications to the hitherto fanciful speculations of geology, excited the liveliest interest among the naturalists of Europe to the curious and novel investigations of M. Cuvier; and the success of his labours in identifying the fossil bones of the mammalia, affords the most splendid illustration of the utility of zootomical knowledge, as applied to geological investigation, which has yet been recorded in the history of that science. The opportunities which M. Cuvier enjoyed for prosecuting these geological inquiries were such as no naturalist ever before possessed; but it must also be said, that no man ever before possessed in a more eminent degree, than Cuvier, all the requisite qualifications for the successful employment of these advantages. His indefatigable industry, and his enthusiasm in these pursuits, his practical acquaintance with all the collateral sciences, and his extensive general knowledge, the beauty of his language, and the elevated tone of his descriptions, the extent and grandeur of his general views, and the sublime truths they have unfolded regarding the past revolutions of the animal kingdom and of the globe we inhabit, convince us that no other naturalist in his situation could have so successfully performed what he accomplished, in regard to the restoration of extinct species of animals. These researches now occupy seven large quarto volumes, illustrated with more than two hundred engraved plates; they have made us acquainted with at least seventy species of animals before entirely unknown to naturalists, and have pointed out the occurrence of eleven or twelve known existing species in a fossil state, besides many other species of animals which have not yet been identified.

Cuvier was appointed, in 1808, one of the councillors for life of the Imperial University, which was created that year by Napoleon. This sedentary appointment accorded well with that of perpetual secretary of the Institute, and led Cuvier often to discuss affairs of administration before the council of state, and in presence of the emperor. In this capacity he was sent in 1809 and 1810, to organize the academies of the Italian states which had been recently added to the empire; and the judicious arrangements which he made at Turin, Genoa, and Pisa, were found so advantageous, that on the return of the respective sovereigns of these states, the measures adopted by Cuvier were preserved inviolate. In 1811 he had a similar mission to Holland and the Hanse Towns, and many of the changes and nominations which he made there, are still respected and preserved. When at Hamburgh he was informed that the emperor had conferred upon him the title of chevalier, with an hereditary endowment. Though a protestant by country, birth, and education, he was sent, in 1813, to organize the University of Rome; and some of the improvements which he introduced into the University of La Sapienza, were retained even after the return of the pope. When in that city, he received intelligence of his appointment as Master of Requests, a place in the ministry, to which he had been called by a personal resolution of Napoleon, who was acquainted with the acts of Cuvier's administration as Councillor of the University, both from his own observation and from the favourable report of Fontane. During his numerous missions through the vast territories formerly subservient to France, on affairs connected with the state, Cuvier never omitted the opportunities they afforded him of prosecuting his favourite scientific investigations.

The great accumulations of the bones of elephants which M. Cuvier saw in Italy, convinced him that they could not have belonged to the few animals of this species lost by Hannibal in traversing that country, but must have belonged to species inhabiting that part of the globe at a much more remote period. The same cause is assigned by him for their remains occurring in England, Ireland, Germany, Denmark, Norway, Poland, Russia, Siberia, and in the islands and shores of the Polar Seas. Kotzebue found them common on the coasts of America within the Arctic Circle, and Parry, in Melville Island, where the temperature is now frequently fifty degrees below the freezing point. The great animal of the Ohio, was restored by Cuvier, the bones of which were considered by Daubenton to belong to the elephant and hippopotamus. Cuvier identified different species of this animal, to which he gave the name Mastodon, from the nipple-like form of the grinding teeth. The fossil hippopotami and rhinoceroses, which are so abundant in the valley of the Arno, Cuvier was enabled to ascertain, by means of the skeletons of the recent species he procured for the Museum. The rhinoceros of Caffraria, described by Sir E. Home, as similar to the fossil species, was shown by M. Cuvier to differ from the latter in not having the septum of the nostrils ossified as in the allied fossil species. The pretended fossil human skeleton of Scheuchzer, which Camper suspected to be that of a lizard, was carefully examined by Cuvier when at Haerlem, where it is preserved in the Museum, and shown to be, what he had previously announced it to be, a gigantic salamander. Cuvier examined at Pavia the collection of fossil bones brought from the Island of Cerigo, and asserted by Spallanzani to be remains of the human species, and found that not a single fragment of them had ever formed a part of a human skeleton, but were all remains of ruminating animals. He determined nearly twelve species of the extinct genus Palæotherium, some of which were nearly as large as a rhinoceros; they appear from the shells which are found along with their bones, to have frequented the banks of rivers and marshes. The immense accumulations of bones found in the caves of Gaylenreuth, on the frontiers of Bayreuth, Cuvier found to have belonged almost entirely to extinct species of bears, which must have lived and died peaceably in the situations where we now discover their remains. The remarkable fossil animal of South America, the Megatherium, which measures twelve feet in length, and six or seven in height; and the Megalonyx, nearly as large, Cuvier ascertained to have been closely allied, in their general characters, to the sloths and ant-eaters of that country. He found the bones of a species of opossum in the gypsum quarries of Paris, and thus confuted the opinion of those who maintained all such bones to have been flooded north from Asia, as the animals of this genus are inhabitants only of the New World. Two species of seals were discovered by Cuvier in the coarse marine limestone of the department of the Maine and Loire, one of which is nearly three times as large as the common species still inhabiting our seas, and in the same locality he found two unknown species of Lamantins. His labours were scarcely less productive in the class of reptiles, of which he pointed out many extraordinary and gigantic species found in a fossil state.

From the examination of the numerous extinct species of animals found in the gypsum quarries of Montmartre, Cuvier was naturally led to study the nature and superposition of the various strata containing them, and in conjunction with M. Brongniart, professor of mineralogy, he undertook a laborious and extensive examination of the geological structure of the Paris basin, and of the surrounding country. The results of their investigations form an important part of the great work on Fossil Organic Remains, and one of the most valuable contributions which geology has ever received. They showed the country around that capital to be formed by a succession of marine and fresh-water deposits, as if by the flux and efflux of salt and fresh water over that extensive district. Above the chalk, which forms the bottom of the great basin they examined, rest the plastic clay and coarse marine limestone, both containing, as well as the chalk itself, remains of marine animals. On these strata rests the great gypsum fresh-water formation, containing remains of quadrupeds, birds, and reptiles, and of fishes and shells belonging to fresh-water species. Marl and sandstone containing the remains of marine animals, lie on the gypsum formation, and these are covered with beds of flint and silicious limestone, abounding with fresh-water shells. All these strata are covered with a dark-coloured carbonaceous alluvium composed of sand, marl and clay, and containing trunks of trees, and bones of elephants, oxen, and other large quadrupeds. These interesting geological details, occupy more than six hundred pages, and are illustrated with geological maps and numerous sections of strata, not only of the Paris basin, but also of similar formations in Italy, Switzerland, and Germany. Numerous plates are also given of the invertebrate animals which occur in these beds, and which were carefully identified by Lamarck, Defrance, Audouin, and other zoologists. The preliminary discourse in the first volume of this work, contains so many grand and original views of the revolutions which have taken place on the surface of this globe, and in the animal kingdom, and is composed in a style at once so profound, elegant, and attractive, that it has long been translated into the English language, both in this country and in America, and more recently also into the German language. The translations of Dr Mitchel. of New

York, and Professor Jameson, of Edinburgh, are enriched with numerous original notes and illustrations; and the translation of the latter has gone through several large editions. In determining the fossil remains of the mammalia, Cuvier considers the examination of the molar teeth as affording by far the most important characters. By these, we at once perceive whether an animal is carnivorous or herbivorous, and when it belongs to the latter order, we can generally determine by the forms of these teeth the particular kind of herbivorous animals to which it is most nearly allied. The ruminating animals differ remarkably in several of their characters from the other orders of mammalia. as in the imperfection of their dental system, in the structure of their stomach, and in the forms of their horns; yet they resemble each other so much, and are so numerous, that their discrimination is attended with great difficulty, both with regard to the recent animals and the extinct species. Important generic characters are often taken from the form of their horns, those most changeable of all their external parts, according to their age, sex, and climate. To facilitate his researches into this numerous tribe of fossil mammalia, M. Cuvier enters at considerable length into the characters of the existing species as taken from the teeth, the head, and the rest of the skeleton, and then describes the different fossil species of deers, oxen, and other ruminating animals, determined chiefly by their horns, and found in various situations in France, Germany, and other parts of Europe. He attempted, in the same manner, to decipher the bones of the ruminating animals found in so great abundance in osseous brecchias, in fissures, and caves, at Gibraltar, Cette, Antibes, Nice, Uliveto, Cape Palinurus, Corsica, Sardinia, Sicily, Dalmatia, Cerigo, Concud, and Verona. His views in regard to the antiquity of these osseous accumulations in caves and fissures, have been modified by the interesting discoveries and conclusions of Professor Buckland; and he agrees with this eminent geologist as to the manner in which these bones have been collected together and enveloped in the diluvium. M. Cuvier proceeds in the same manner with the numerous order of carnivorous animals as with the ruminantia, to determine the osteological characters of the various existing races, before attempting to identify the fossil species. The teeth present very important and useful discriminating characters, both in the carnivora and rodentia, from the striking diversities they exhibit in the genera of these orders.

The number of rodentia appears to have been as great in the ancient world as at present, and most of the species appear to have been small as those now met with in a living state. After showing the gradual transition to this order of quadrupeds in the systems of dentition, presented by the species belonging to the marsupial genera phalangista, macropus, and phascolomys, Cuvier details the characters of the order rodentia, and of the recent genera it comprehends, and enters particularly into the description of the molar teeth, the form of the head, and the characters which may be obtained from the other parts of the skeleton. In treating of the fossil rodentia, particularly those found in caves, he has given a full account of the interesting researches of Dr Buckland, in regard to the species of this order met with in the caves of Kirkdale, and has endeavoured to identify some of the separate bones of these animals represented in the plates of the Reliquiæ Diluvianæ. These bones appear to have belonged chiefly to species of mice, rats, and hares. The Trogontherium Cuvieri, is a large fossil species belonging to this order, and agreeing in all its characters with the genus castor; it was found on the sandy banks of the sea of Azof, and measures a fifth larger than the recent species of Europe or America. The skeletons of those singular quadrupeds, the sloths, ant-eaters, and monotremata, are the next described. Cuvier was the first to point out to Daubenton, the remarkable irregularity observed in the cervical vertebræ of the sloth, called the Ai, where their number amounts to nine, being two more than are met with in almost all the other mammalia. The great length of the anterior extremities of this animal, and of some other sloths, is regarded by Cuvier, as a principal cause of their remarkable slowness of motion, and of their feebleness. They present, likewise, remarkable peculiarities in the form of the pelvis, and in the union of its parts, in the mode of articulation of the hind feet, in the rigidity of all the parts of the toes, in the manner in which the long nails are folded under the feet during a state of rest, and in the articulations of the scapula and clavicle. The details on the osteology of the monotremata, though not applied to the determination of any fossil remains, form a most valuable contribution towards the anatomy of these most singular of all the animals hitherto brought from New Holland, and whose structure and nature have so much perplexed the most eminent anatomists of Europe. The only fossil species hitherto discovered, belonging to the order edentata, are the megalonyx of Jefferson, from North America, the great megatherium from Paraguay, and another gigantic, though still unknown species, of which Cuvier was able to examine the plaster model of a phalanx found in a pit of sand and gravel, supposed to have been formed by deposition from the Rhine, near Eppelsheim, in Hesse. The fossil species of marine mammalia are much more numerous, and Cuvier described and figured the remains of extinct species of seals, lamantins, dolphins, narwals, whales, and cetaceous animals allied to the hyperoodons and cachalots, which he was particularly enabled to illustrate, by means of the rich collection of these animals preserved in his museum in the Garden of Plants. He did not, however, describe all the remains of these animals in his possession, but selected only those which afforded the means of being satisfactorily determined. By thus pointing out many species of marine mammalia, which are now extinct, he further confirmed the conclusion to which naturalists had been led by the study of fossil conchology; that not only the productions of the land have been changed by the revolutions which have taken place on the surface of the globe, but that the sea itself, the chief agent in most of these revolutions, has changed its inhabitants. The gigantic bulk and force of the cetacea have not better protected their species in the ocean, than the size and strength of the elephants, rhinoceroses, hippopotami, mastodons, and megatheria, have enabled them to resist on land the revolutions which have destroyed their race.

It is not a little remarkable, that among the fossil remains of vertebrate animals, there should so seldom be found the bones either of birds or of serpents. This cannot be ascribed merely to the delicacy of their skeleton, and the consequent difficulty of preserving it in the rocky strata, or of collecting its parts, from these ancient beds, as we find in many of the older strata, the skeletons of the smallest fishes preserved with the most delicate spines of their fins uninjured. The saurian reptiles are much more common, and the batrachia are also frequently found in a fossil state. The crocodile, of all the saurian reptiles, presents the nearest affinities in its osteology, to that of the mammalia; in determining the nature of its separate bones, their relative position is examined, the muscles which are attached to them are considered, the blood vessels and nerves which pass through their foramina are ascertained, and all similar indications are carefully sought for and applied. From this determination of the bones, particularly those of the head of the crocodile, we obtain a solution of the more difficult analogies in the osteology of the other saurian reptiles, and likewise of the tortoises and serpents. The batrachian reptiles present anomalies which require a different kind of investigation from that of the other orders of their class. M. Cuvier deprecates, as visionary, the ingenious views of those who endeavour to decipher the osteology of the cranium of these animals, by comparing the bones of the head of vertebrate animals to a series of dilated vertebræ. After thus carefully determining the osteology of each of the recent genera of reptiles, and illustrating all the details with large engravings, he proceeds to examine the characters of the remarkable extinct species of these animals. The remains of reptiles occupy a series of strata much more ancient than those which contain the fossil bones of mammalia, even of the aquatic species. The chalk formation, and all the strata of anterior date, present no trace of the former existence of mammiferous animals, which are all confined to newer formations; but the chalk strata, and all the older strata of the secondary series, to the great coal formation, abound with remains of tortoises, crocodiles, and lizards, which have even left distinct traces of their footsteps on the now solid sandstones of the latter formation, as in the sandstone quarries of Dumfriesshire in Scotland, although very few of these animals are now found in strata newer than the chalk. At the remote period alluded to, only cold-blooded reptiles moved upon the dry land, and the bottom of the sea was peopled with species of ammonites, belemnites, terebratulites, encrinites, and many other genera now almost entirely extinct.

After establishing the division of the great family of crocodiles into three subgenera of alligators, crocodiles properly so called, and gavials, (the first of which is distinguished by having the fourth tooth of the lower jaw on each side, received into a depression of the upper jaw-bone, and by having the feet semi-palmated; the second, by the same tooth on each side of the lower jaw, passing through a distinct fissure of the upper maxillary bones, the feet palmated, and the beak oblong; and the gavials forming the third division, are distinguished from the other two subgenera, by having an elongated cylindrical beak, and palmated feet,) M. Cuvier examines, with great minuteness and detail, the separate bones of the living species of crocodiles. The bones of the head are carefully compared with the corresponding bones of the mammalia, the bones of the trunk and extremities are illustrated with equal detail, and the whole skeleton is contrasted with those of the alligators and gavials at present existing. The fossil species of these animals are next described; both those known to preceding observers, and those ascertained by M. Cuvier. In the same manner, the recent and fossil species of chelonian reptiles, the land and fresh water tortoises, and those which still inhabit the sea, and the fossil species found in various parts of Italy, France, Switzerland, Germany, and England, are described. He also examines the facts connected with the fossil monitors found at Thuringia and other parts of Germany; the great saurian reptile found in the quarries of Maestricht; the gigantic lizard, discovered by Sœmmering near Monheim, and termed geosaurus by Cuvier; the huge megalosaurus, found by Buckland in the oolite of Stonesfield, near Oxford; the saurian reptile, discovered by Gaillardeau, in the quarries of compact limestone near Lunéville; and the four discovered species of pterodactylus, a genus distinguished by the extraordinary length of the fourth toe of the anterior extremities. The observations and plates, illustrative of the osteology of the recent species of batrachian reptiles, form a valuable contribution to comparative anatomy; and the details regarding the fossil bones of the great aquatic salamander, from the quarries of Æningen, which Scheuchzer regarded as those of the human species, are full and satisfactory.

The views of M. Cuvier regarding the extinct races of vertebrate animals, and the facts he collected relating to them, were first published as a series of detached memoirs in the Annales du Museum d' Histoire Naturelle; and in 1812, these memoirs were collected by the author, connected together by means of supplementary articles, and a preliminary discourse, and published as a separate work, forming the first edition of his "Recherches sur les Ossemens Fossiles," in four quarto volumes. A second edition was published in 1817, in five volumes quarto. After nearly ten years of continued research in the same interesting field of inquiry in various parts of Europe, M. Cuvier commenced, in 1821, a new edition of the work, which was completed in 1824, in seven quarto volumes, though forming only five according to the plan of the work. This work, which is the greatest monument of the genius, learning, and industry of Cuvier, reformed the science of geology, and greatly advanced our knowledge of comparative anatomy; and is justly styled, by our most eminent mineralogist, Professor Jameson, the most splendid contribution to Natural History furnished by any individual of this age.

A period of twenty years elapsed from the publication of the Tableau Elementaire to the appearance of the first edition of the Règne Animal, in 1817, during which, the study of comparative anatomy and zoology had been cultivated with increased ardour in every part of Europe, and our knowledge of the organization and species of the animal kingdom had been almost doubled. This rapid advancement was principally due to the continued and well-directed exertions of M. Cuvier, to the eloquence and genius of his writings, to the importance, originality, and attractive nature of his views, and to the greatly increased opportunities afforded him by his situation in the Garden of Plants. From the comprehensive nature of the Règne Animal, embracing equally the structure and history of all the existing and extinct races of animals, this work may be viewed as an epitome of M. Cuvier's zoological labours; and it presents the best outline, which exists in any language, of the present state of zoology and comparative anatomy. The work is in four volumes octavo, with fifteen plates, and treats of the organization and characters of all the divisions, classes, orders, and genera of the animal kingdom, from man to the lowest of the infusoria. The third volume, treating of the three principal classes of articulated animals, was entirely composed by M. Latreille, and the concurrent testimony of all the naturalists of Europe in favour of his views, afforded M. Cuvier a convincing proof of the correctness of his choice, in selecting that profound entomologist to conduct this important part of the work.

The four great divisions of the animal kingdom pointed out in the Tableau Elementaire, were adopted in both editions of the Règne Animal, and established by more extended details, and by characters more precise and correct. These four divisions are termed vertebrata, mollusca, articulata, and radiata; and each of them comprehends several classes. They are founded on extensive and accurate analogies, and have been sanctioned by long and general adoption; but they convey no idea of any uniform principle of classification applied to the whole animal kingdom. The first division is founded on the presence of the vertebral column, a part of the organization of comparatively little importance in the economy; the second division is founded on the general softness of the body when deprived of its skeleton, a character which becomes more and more appropriate to the classes of animals as we recede from the mollusca towards the infusoria; the third is founded on the divisions or articulations of the skeleton, which are merely the result of its covering the surface of these animals, and have no important influence on the rest of the organization; and the fourth is established on a peculiarity in the external form of the body, almost limited to the echinodermata, and not applicable to the entozoa, zoophyta, and infusoria, which constitute by much the greatest portion of this division. We cannot help thinking, that the science of comparative anatomy is now so far advanced, as to afford the means of distributing the animal kingdom on some more uniform and philosophical principles,—as on the modifications of those systems or functions which are most general in the animal economy. The characters for such a philosophical distribution, might be looked for in the modifications of the generative system, or the digestive, or the nervous system; and, indeed, attempts have already been made, both in Germany and in this country, to found the divisions of the animal kingdom, on the simple modifications presented by the nervous system. It is greatly to be regretted, that with his vast resources for the improvement of this part of our nomenclature and arrangement, he overlooked these minutiæ of zoological distribution, and remained fettered by his earliest views of classification. Had he taken the same liberties with his own classifications in every successive publication, which he took with those of Linnæus when he attacked and reformed them, the present room for improvement in all this part of the science could not have existed.

The first great division of the animal kingdom, M. Cuvier divided, as is usually done, into four classes: viz., mammalia, aves, reptilia, pisces.* The term amphibia, employed by Lin-

---

* The first subdivision, of the class *Mammalia*, is again subdivided into eight orders, as follows :—

Order I.—Bimana.

Having hands at the anterior extremities alone.
One species—man.

Order II.—Quadrumana.

Having hands at the four extremities.
Simia (Monkey.)—*Ouistiti.*—*Makis* or *Lemurs.*

Order III.—Carnassiers.

Family i.—Cheiroptera.

Vespertilio (Bat.)—*Galeopithecus.*

Family ii.—Insectivora.

Erinaceus (Hedgehog.)—*Tendrac* (*Centenes*, Illig.)—*Cladobates* (Tupais.)—*Sorex* (Shrew.)—*Mygale* (Desman.)—*Chrysochloris.*—*Talpa* (Mole.)—*Condylura.*—*Scalops* (Shrew-Mole.)

Family iii.—Carnivora.

Tribe i.—Plantigrade.

Ursus (Bear.)

Tribe ii.—Digitigrade.

Mustela (Marten.)—*Canis* (Dog.)—*Viverra* (Civet.)—*Hyæna.*—*Felis* (Cat.)

Tribe iii.—Amphibious animals.

Phoca (Seal.)—*Trichechus* (Morse)

Order IV.—Marsupial animals.

Didelphis (Opossum.)—*Dasyurus.*—*Phalangista.*—*Potorous* (*Hypsiprymnus*, Illig.)—*Macropus* (Kangaroo.)—*Koala* (*Lipurus*, Goldf.) *Phascolarctos.*—*Phascolomys* (Wombat.)

Order V.—Glires (rodentia.)

Sciurus (Squirrel.)—*Mus* (Rat.)—*Helamys* (*Pedetes*, Illig.)—*Spalax.*—*Orycterus.*—*Geomys* (*Pseudostoma*, Say.)—*Diplostoma.*—*Castor* (Beaver.)—*Couia* (*Myopotamus*, Comm.)—*Hystrix* (Porcupine.)—*Lepus* (Hare.)—*Cavia* (Guinea Pig.)

Order VI.—Edentata.

Tribe i.—Tardigrade.

Bradypus (Sloth.)—*Megatherium* (fossil.)

Tribe ii.—Common Edentata.

Dasypus (Tatou.)—*Orycteropus.*—*Myrmecophaga* (Anteater.)—*Manis* (Pangolin.)

Tribe iii.—Monotrema.

Echidna (Spinous Anteater.)—*Ornithorhynchus* (*Platypus*, Shaw.)

Order VII.—Pachydermata.

Family i.—Proboscidiana.

Elephas.—*Mastodon* (fossil.)

Family ii.—Common Pachydermata.

Hippopotamus.—*Sus* (Hog.)—*Phacochœrus.*—*Dicotyles* (Pecnæus, Blumenbach, and many other naturalists, for the four-footed reptiles is used by Cuvier for a small group of aquatic mammalia, comprehending the seal and the walrus. In the first edition of the Règne Animal, (1817), the class mammalia is divided into eight orders, bimana, quadrumana, sarcophaga, rodentia, edentata, pachydermata, ruminantia, and cetacea. In the

---

cary.)—*Anoplotherium* (fossil.)—*Rhinoceros.*—*Hyrax Palæotherium* (fossil.)—*Lophiodon* (fossil.)—*Tapir.*

FAMILY III.—SOLIPED.

Equus (Horse.)

ORDER VIII.—RUMINANTIA.

(Without horns.)

Camelus.—*Moschus.*

(Horned.)

Cervus (Deer.)—*Camelopardalis* (Giraffe.)—*Antelope.*—*Capra* (Goat.)—*Ovis* (Sheep.)—*Bos* (Ox.)

ORDER IX.—CETACEA.

FAMILY I.—HERBIVOROUS.

Manatus (Lamantin.)—*Dugong* (*Halicorus*, Illig.)—*Stellaras Rytina*, Illig.)

FAMILY II.—COMMON CETACEA.

Delphinus (Dolphin.)—*Narwhal* (*Monodon*, L.)—*Cachalot* (*Physeter*, L.)—*Balæna.*

Of the class *Aves*, Cuvier makes the following subdivisions:—1. BIRDS OF PREY (*accipitres*,) Lin.;) distinguished by their crooked beak and claws, by means of which they are enabled to overcome and prey upon other birds, and even the weaker quadrupeds. They hold the same rank among birds as the *carnivora* among quadrupeds. They all have four toes, and the nails of the great and middle toes are the strongest. They form two families, the DIURNAL and NOCTURNAL: the first having nostrils inserted in a naked cere, three toes before and one behind, without feathers; eyes directed sideways: the second having nostrils at the anterior edge of the cere, which is more or less covered with stiff hairs; the external toe capable of being turned behind; eyes large, directed forwards.—2. PASSERINE (*passeres.*) This is the largest class, and embraces all birds which do not belong to the other five; they present a great resemblance in their structure, and the genera are so closely allied that it is difficult to distinguish between them. They may, however, be separated into two great divisions; 1. those with the exterior toe united to the middle one, by one or two joints only; 2. exterior toe almost as long as the middle one, and united to it as far as the last joint but one.—3. CLIMBERS (*scansores;*) birds whose exterior toe directs itself backwards like the great toe, affording a very solid support, by which some of them profit in clinging to, and climbing the trunks of trees.—4. GALLINACEOUS BIRDS (*gallinaceæ.*) These have a heavy gait, a short flight, a medium-sized beak the upper mandible vaulted, nostrils partly covered by a cartilaginous scale, toes generally dentated at the edges, with short membranes between those in front.—5. WADERS (*grallæ*) may be recognised by the nudity of the lower part of their thighs, very frequently the length of their legs, generally some little web, at least, between the external toes. In flying, they extend their legs behind them, contrary to the habit of other birds, who draw them up close to the body.—6. WEB-FOOTED BIRDS (*palmipedes*) are strongly characterized by their feet, formed for swimming, that is, being affixed to the hinder part of their body, with very short and compressed tarsi; and palmated between the toes. They are the only birds in which the length of the neck exceeds that of the legs.—Each of these orders is subdivided into families and genera, principally according to the formation of the beak.

While we have thought it proper to give a brief outline of Cuvier's classification of Birds, we have in the plates adopted the system of Temminck, with the addition of some new genera. This arrangement is simple and distinct, and but slightly altered from that of Linnæus. He separates the class Aves or Birds into sixteen orders, with the following characters:—

I. RAPACES.—Birds of prey.
II. OMNIVORES.—Such as live on all kinds of food.
III. INSECTIVORES.—Those which feed principally on insects.
IV. GRANIVORES.—Birds which feed on grain.
V. ZYGODACTYLI.—Those having two toes before, and two behind, pl. 20, f. 43.
VI. ANISODACTYLI.—Those which have the middle toe joined to the exterior one at the base, pl. 20, f. 42.
VII. ALCYONES.—Those having three toes before united, and one behind, pl. 20, f. 44.
VIII. CHELIDONES.—Having short legs, three toes before divided, or only united at the base by a short membrane; the hinder toe often reversable, pl. 20, f. 46.
IX. COLUMBÆ.—Those which have three toes before, entirely separated, and one behind.
X. GALLINÆ.—Having three toes before, entirely separated; the hinder toe united to the tarsus above the joint of the other toes.
XI. ALECTORIDES.—Birds having a long and slender tarsus; three toes before, and one behind; the hinder toe articulated higher on the tarsus than those in front.
XII. CURSORES.—Birds with long legs, naked above the knee, with two or three toes directed forwards, pl. 20, f. 45 and 49.
XIII. GRALLATORES.—Those birds which have long and slender legs, more or less naked above the knee; three toes before and one behind. the hinder one jointed on the same level with the others, or more elevated.
XIV. PINNATIPEDES.—Birds with feet of medium length; the tarsi slender or compressed; three toes before and one behind, with a rudimentary membrane along the sides of the toes; the hinder one joined interiorly to the tarsus, pl. 20, f. 62.
XV. PALMIPEDES.—Those which have short feet, more or less drawn up to the abdomen; anterior toes partly or wholly united by a membrane; the posterior toe articulated interiorly upon the tarsus, or totally wanting in some genera, pl. 20. f. 47.
XVI.—Birds whose legs are retracted into the abdomen; feet with three toes divided in front; the hinder toe short, and articulated anteriorly, pl. 20, f. 48.

TERMINOLOGY OF THE PARTS OF BIRDS.

Of the Skeleton. Pl. 20, f. 39.

a a. The vertebræ of the neck, or cervical bones.
b. The metacarpal bones.
c The phalanges.
d. The Ulna.
e. The metacarpal bone of thumb.
f f. The ball of the Ulna.
g. The radius.
h. The os humeri.
i. The atlas.
k. The ribs.
l l. The tibia, or thigh-bone.
m. The fibula, or leg-bone.
n. The ball of the tarsus.
o. The tarsus.
p p. The phalanges of the toes.
q. The phalanges of the heel.
r. The sternum, or breast-bone.
s s. The clavicle, or collar-bone.
t. The last true rib.
u. The vertebræ of the back.
v. The pelvis.
w. The vertebræ of the tail.
x. The os coccygis.

External Anatomy of Birds. Pl. 20. f, 41.

Parts of the head and neck.
a, b, g. Upper mandible.
a to g. Culmen, or ridge of the bill.
g. Frons, or forehead.
h. Corona, or crown of the head.
i. Sinciput, or hinder part of the head.
o. Nucha, or nape of the neck.
k. Supercilium, or eye-brows.
m. The ear covers, or auricles.
d. Under mandible.
e. Barba, or beard.
R. Notch.
f. Mentum, or chin.
r. Gula, or gullet.
s. Jugulum, or lower part of the throat.
p. Auchenium, or lower part of the neck.

Back.
V V. Interscapulum, or space between the shoulder blades
S S. Tergum, or middle of the back.
I. Uropygium, or rump.
H. The tail coverts.

Body.
t. Pectus, the breast.
W. Epigastrum, or stomach.
A A. Abdomen.
Z Z. Venter, or belly.
Y. Hypochondria, sides of the abdomen.
B. Crissum, or vent.

Wing.
D D. *Tectrices minores*, or lesser wing-coverts.
E E. *Tectrices mediæ*, or middle wing-coverts.
Z Z. *Scapulares*, scapulars.
F. *Primariæ*, Primaries, or quills.
G. *Remiges*, or rowers.
X. *Alula spuria*, or bastard wing; f. 40, bone of do. at *d c*; feathers of do. *e*.
U. *Humeri*, or shoulders of the wing.

Tail.
K. *Rectrices intermediæ*, or middle tail feathers.
L. *Rectrices laterales*, or side tail feathers.

Legs.
M. Tibia, or thigh.
a. Tarsus, or shank.
Digiti, or toes,
P. P. Hallux, heel, or hind toe.
O O. Acrostarsium, or front of the leg.

great order sarcophaga, the bat and the walrus, the lion and the mole, the kangaroo and the hedgehog, are all placed under the same division, from having claws and three kinds of teeth. The marsupial quadrupeds, in the new edition of the work, are removed from this singular group to form a separate order; but the other discordant families are still left together in the

---

The Bones of the Wing and their Feathers. Pl. 20. f. 40.

a. This wing bone is termed the Brachium, or arm.

b the cubitus, c, the carpus, d the spurious wing bone, e the primaries, f the secondaries, g the tertials.

Examples of Bills. Pl. 20.

F. 53. A straight bill with an inflected point, genus *Vultur*.
F. 52. A straight bill, notched towards the point. *Barita.*
F. 50. A robust bill, serrated at the point of the upper mandible *Opathus*.
F. 54. A robust notched bill. *Trogon.*
F. 55. A straight cuneate bill. *Corvus.*
F. 56. A cylindrical bill, with reflected sirri. *Mergus.*
F. 57. A recurved bill. *Mycteria.*
F. 62. An elongated, compressed bill, with a turgid lip. *Scolopax.*
F. 59. A gibbous arcuated bill. *Psittacus.*
F. 60. A spatulate bill. *Platalea.*
F. 61. A groping bill. *Anastomus.*
F. 51. A straight, narrow bill, as in *Quiscalus*.
F. 58. A slender, curved, depressed bill. *Phalaropus.*

ORDER I.—RAPACES.

Bill short, strong; upper mandible covered at its base by a cere, compressed, and hooked towards its extremity; nostrils open; legs strong, muscular, generally short, and feathered to the knees or feet, with three toes in front, and one behind, either divided or united at the base by a membrane; middle toe longest, and united with the exterior one at the base.

Vultur fulvous; Griffon Vulture, pl. 15, fig. 1. *Cathartes Papa;* King of the Vultures, pl. 16, fig. 1. *Gypaetus barbatus;* Bearded Vulture, pl. 16, f. 9. *Gypogeranus Serpentarius;* Secretary, pl. 16, f. 3. *Polyborus vulgaris;* Brazilian Caracara Eagle, pl. 16, f. 6. *Falco Islandicus;* Jerfalcon, pl. 15, fig. 3. *Harpyia destructor;* The Harpy Eagle, pl. 16, fig. 7. *Aquila fucosa;* Wedge-tailed Eagle, pl. 16, f. 2. *Haliaetus leucocephalus;* White-headed Eagle, pl. 15, fig. 2. *Astur atracapillus;* Goshawk, pl. 16, fig. 13. *Buteo Americanus;* American Hen Harrier, pl. 16, f. 10. *Elanus furcatus;* Swallow tailed Hawk. pl. 16, f. 12. *Bubo nævia;* Mottled Owl, pl. 16, f. 11. *Noctua Dalhousiei;* Dalhousie's Owl, pl. 15, fig. 4.

ORDER II.—OMNIVORA.

Bill of medium size, robust, sharp at the edges; upper mandible more or less convex, and notched near the point; feet provided with four toes, three before, and one behind; wings of medium size, with the quill-feathers terminating in a point.

Opisthocomus cristatus; Crested Hoatzin, pl. 15, fig. 27. *Buceros Abyssinicus;* Abyssinian Hornbill, pl. 15, f. 6. *Prionites ruficapillus;* Red Headed Saw-bill, pl. 17, fig. 6. *Corvus Corax;* Raven, pl. 15, fig. 7. *Garrulus Canadensis;* Canada Jay, pl. 15, f. 8. *Quiscalus Versicolor;* Purple Grakle, pl. 15, f. 23. *Nucifraga guttata;* Speckled Nutcracker, pl. 15, f. 22. *Pyrrhocorax alpinus;* Red-legged Crow, pl. 15, f. 12. *Barita cractica;* Noisy Roller, pl. 15, f. 11. *Glaucopis cinerea;* Wattle Bird, pl. 15, f. 13. *Gracula religiosa;* Sacred Mino, pl. 15, f. 10. *Bufaga rubescens;* Reddish Oxpecker, pl. 15, f. 19. *Bombycivora sedorum;* Cedar Bird, pl. 15, f. 30. *Ptilonorynchus nuchalis;* Ruffed Ptilonorynchus, pl. 17, f. 20. *Coracias viridis;* Green Roller, pl. 17, f. 5. *Colaris Afra;* African Colaris, or Roller, pl. 17, f. 12. *Oriolus Sinensis;* Chinese Oriole, pl. 15. f. 15 *Icterus Phœniceus;* Red-wing Troopial, pl. 17, f. 2. *Yephantes spurius;* Orchard Baltimore, pl. 17, f. 4. *Sturnus unicolor;* Sardinian Starling, pl. 17, f. 1. *Pastor cristatellus;* Chinese Pastor, pl. 15, f. 26. *Paradisea rubra;* Red-tailed Bird of Paradise, pl. 15, f. 16. *Ptiloris Paradiseus;* New Holland Ptiloris, pl. 17, f. 21. *Lamprotornis gularis;* Gorget Bird of Paradise, pl. 16, fig. 4.

ORDER III.—INSECTIVORA.

Bill of medium size, or short, straight, rounded, or awl-shaped, slightly edged; upper mandible curved and notched at the point; frequently provided at the base with coarse protruding hairs; feet with three toes before, and one behind, articulated on the same level, the exterior united at its base, or to the first joint of the middle toe.

Merula livida; Cat Thrush, pl. 17, fig. 43. *Chloropsis gampsorhynchus;* Hooked-billed Chloropsis, pl. 17, f. 22. *Cinclus superciliosa;* Supercilious Dipper, pl. 15, f. 28. *Menura Novæ Hollandiæ;* New Holland Menura, pl. 17, f. 3. *Pitta cyanura;* Blue-tailed Pitta, pl. 17, f. 8. *Myiothera fusca;* Brown Antcatcher, pl. 17, f. 10. *Thamnophilus olivaceus;* Olive Bush-Shrike, pl. 15, f. 36. *Vanga cristata;* Crested Vanga, pl. 17, fig. 7. *Lanius excubitor;* Great American Shrike, pl 17, f. 11. *Psaris Vieilloti;* Vieillot's Psaris, pl. 17, f. 23. *Sparactes cristatus;* Crested Sparactes, pl 17, f. 24. *Ocypterus viridis;* Madagascar Ocypterus. *Tricophorus barbatus;* Bearded Tricophorus, pl. 16, fig. 2. *Edolius cristatus;* Crested Edolius, pl. 17, fig. 25. *Ceblepyris niger;* Black Ceblepyris, pl. 16, f. 17. *Coracina gymnodera;* Bare-necked Coracina, pl. 17, f. 26. *Querula rubicollis;* Purple Throated Querula, pl. 16, f. 15. *Amplis cærulea;* Blue Chatterer, pl. 17. f. 49. *Casmarhynchos variegatus;* Variegated Chatterer, pl. 17, f. 28. *Procinias ventralis;* Blue Berry-eater, pl. 16, fig. 8. *Rupicola elegans;* Elegant Rupicola, pl. 17, fig. 13. *Phibalura flavirostris;* Yellow-billed Phibalura, pl. 17, f. 29. *Pipra caudata;* Fork-tailed Manakin, pl. 17, f. 14. *Pardalotus striatus;* Striated Manakin, pl. 17, f. 48. *Todus viridis;* Green Tody, pl. 17, f. 16. *Platyrhynchos colloris;* Collared Platyrhynchos, pl. 16, f. 14. *Muscipeta regia;* Coast Muscipeta, pl. 17, f. 44. *Muscicapa Saya;* Says Muscicapa, pl. 15, f. 25. *Setophaga cærulea;* Blue Gnat-catcher, pl. 17, fig. 45. *Vireo olivacea;* Red-eyed Chat, pl. 15, f. 25. *Malurus Brownii;* Brown's Malurus, pl. 17, f. 36. *Sylvia virens;* Black-throated Green Warbler, pl. 15, f 20. *Regulus Americanus;* American Kinglet, pl. 15, f. 14. *Troglodytes palustris;* Marsh Wren, pl. 17, f. 42. *Saxicola rubicola;* Stone Chat, pl. 17, f. 46. *Accentor alpinus;* Alpine accentor, pl. 17, f. 47. *Motacillo Borealis;* The Artic Wagtail, pl. 15, f. 35. *Enicurus coronatus;* White-crowned Enicurus, pl. 16, fig. 22. *Anthus rufulus;* Reddish Petit, pl. 16, f. 46. *Neops ruficauda;* Red-tailed Neops. pl. 10, f. 5.

ORDER IV.—GRANIVORA.

Bill more or less conical, short, strong; culmen, or ridge, more or less depressed, advancing upon the forehead; mandibles generally destitute of notches; three toes before, and one behind, the anterior ones entirely divided; wings of medium length.

Alauda arvensis; Skylark, pl. 17, f. 9. *Parus ater;* Coal Titmouse, pl. 15, f. 5. *Emberisa Lapponica;* Lapland Long-spurred Bunting, pl. 17, f. 41. *Tanagra multicolor;* Many-coloured Tanager, pl 17, f. 30. *Saltator olivaceus;* Olive-coloured Saltator, pl. 16, f. 25. *Ploceus personatus;* Masked Weaver, pl. 17, f. 31. *Loxia leucoptera;* White-winged Crossbill, pl. 17, f. 38. *Psitterostra psittacea;* Sandwich Island Parrot Bill. *Pyrrhula vespertina;* Evening Grosbeak, pl. 17. f. 33. *Vidua superciliosa;* Supercilious Whidaw Bunting, pl. 17, f. 32. *Fringilla elegans;* Elegant Linnet, pl. 16, f. 21. *Phytotoma Bloxami;* Bloxam's Plant-Cutter, pl. 17, f. 37. *Hyreus Abyssinius;* Abyssinian Hyreus, pl. 17, f. 35. *Colius Senegalensis;* Senegal Coly, pl. 17, f. 39.

ORDER V.—ZYGODACTYLI.

Bills of different forms, more or less curved, or greatly hooked, frequently straight and angular; feet always with two toes before and two behind, the exterior hind toe often reversible.

Family I.—Bill more or less curved; feet with two toes before and generally two behind, the exterior hind toes in some instances reversible.

Musophaga variegata; Variegated Musophaga, pl. 16, f. 26. *Indicator major;* Great Honey Guide, pl. 16, f. 23. *Cuculus cupreus;* Cupreous Cuckow, pl. 16, f. 28. *Coccyzus cæruleus;* Blue Cuckoo, pl. 16, f. 29. *Centropus Senegalensis;* Senegal Coucal, pl. 16, f. 30. *Phænicophaus pyrrhocephalus;* Malcoho, pl. 16, f. 31. *Leptosomus viridis;* African Cuckoo, pl. 16, f. 32. *Scythrops Novæ Hollandiæ;* New Holland Scythrops, pl. 16, f. 33. *Saurothera vetula;* Long-bellied Cuckoo, pl. 16, f. 19. *Pteroglossus maculatus;* Spotted-billed Aragou, pl. 17, f. 18. *Ramphastos Aricari;* Aracari Toucan, pl. 17, f. 15. *Crotophaga ani;* American keel-bill, pl. 17, f. 19. *Trogon Pavonius;* Quizel, pl. 15, fig. 21. *Capito cyanocollis;* Blue-necked Barbet, pl. 16, fig. 24. *Bucco tamatia;* Spotted-bellied Barbet, pl. 16, f. 27. *Pogonias erythromelas;* Red-throated Pogonius, pl. 16, f. 34. *Psittacus discurus;* Racket-tailed Parrot, pl. 16, f. 35.

FAMILY II.—BILLS STRAIGHT AND ANGULAR.

Picus Megillanicus; Magellanic Woodpecker, pl. 16, f. 30. *Galbula macroura;* Gold and Green Jacmar, pl. 17, f. 17. *Yunx torquilla;* Wryneck, pl. 15, f. 9.

ORDER VI.—ANISODACTYLI.

Bill more or less arcuated, frequently straight; always subulate and slender; feet with three toes before and one behind, external one united at the base to the middle one; hullux generally long, all having long, bent claws.

Oxyrhynchus flammiceps; Bright-billed Oxyrhynchus, pl. 16, f. 34. *Sitta pusilla;* Slender Nuthatch, pl 15, f. 17. *Orthonyx maculatus;* Spotted Orthonyx, pl. 17, f. 40. *Dendrocolaptes calcirostris;* Hookbilled Dendrocolaptes, pl. 16, f. 40. *Xenops genibarbis;* the Xenops, pl. 17, f. 39 *Anabates leucophrus;* White-browed Anabates, pl. 16, f. 42. *Opetiorhynchus rufus;* Reddish Opetiorhynchus, pl. 16, f. 18. *Certhia maculata;* Black and White Creeper, pl. 15, f. 18. *Cærebа cyanea*, Azure Creeper, pl, 16, f. 16. *Trochilus eurynomus;* Scaly-backed Humming Bird, pl. 15 f. 33. *Nectarinia vis-*

same order, although Blumenbach and others had already separated the cheiroptera to form a division equal in importance to that of the quadrumana. The class of birds is divided in both editions of the Règne Animal into six orders, nearly analogous to the six orders of Linnæus, accipitres, passeres, scansores, gallinæ, grallæ, palmipedes. The division of reptiles into four

---

lanogaster; Black-breasted Soui-Manga, pl. 16, f. 37. *Climacteris scandens;* Climbing Climacteris, pl. 16, f. 45. *Tichodroma phænicoptera;* Wall Creeper, pl. 16, f. 43. *Upupa epops;* Hoopoe, pl. 15, f. 31. *Epimachus Brisbanii;* Brisbane's Epimachus, pl. 16, f. 47. *Drepanis vestiaria;* Scarlet Drepanis, pl. 16, f. 38. *Meliphaga lunulata;* Crescent Naped 'Honey Eater, pl. 16, f. 44.

ORDER VII.—ALCYONES.

Bill long, or of medium size; pointed and nearly quadrangular, either slightly arcuated or straight; tarsus very short; three toes united before and one behind.

Merops Bullokii; Bullock's Bee Eater, pl. 15, f. 32. *Alcedo Macleayii;* Macleay's Kingfisher, pl. 16, f. 48. *Dacelo gigantea;* Gigantic Dacelo, pl. 15, f. 34.

ORDER VIII.—CHELIDONES.

Bill very short, greatly depressed, and very wide at the base; upper mandible curved at the point; legs short; three toes before, either entirely divided or connected at the base by a short membrane; hallux reversible; claws much hooked; wings long.

Hirundo albicollis; White-necked Swallow, pl. 18, f. 2. *Cypselus melbus;* White-bellied Swift, pl. 18, f. 4. *Caprimulgus leopetis;* Berbice Goatsucker, pl. 18, f. 9. *Podargus humeralis;* Cold-River Night Jar, pl. 18, f. 7.

ORDER IX.—COLUMBÆ.

Columba aromatica; Aromatic Pigeon, pl. 15, f. 30. *Lophyrus coronatus;* Crowned Pigeon, pl. 15, f. 24.

ORDER X.—GALLINÆ.

Bill short, convex in some genera, covered by a cere; upper mandible arcuated from its base, in some species, bent only at the point; nostrils lateral, covered by a membrane, naked or surmounted by feathers; tarsus long; three anterior toes, united at their base by a membrane; hallux articulated on the tarsus above the junction of the anterior toes.

Pavo muticus; Japan Peacock, pl. 18, fig. 5. *Euplocomus ignitus;* Macartney's Cock, pl. 18, f. 3. *Gallus furcatus;* Fork-tailed Cock, pl. 18, f. 22. *Phasianus versicolar;* Diard's Pheasant, pl. 18, f. 10. *Lohephorus impeyanus;* Impeyan Lohophorus, pl. 18, f. 6. *Tragopan satyrus;* Nepaul Tragopan, pl. 18, f. 24. *Polyplectron emphanum;* Crested Polyplectron, pl. 18, f. 13. *Meleagris ocellata;* Honduras Turkey, pl. 18, f. 15. *Argus giganteus;* Argus Pheasant, pl. 18, f. 8. *Numida cristatus;* Crested Pintado, pl. 18, f. 11. *Pauxi galeata;* Galeated Curassow, pl. 18, f. 1. *Crax alector,* Crested Curassow, pl. 18, f. 12. *Penelope marail;* Marail, pl. 18, f. 14. *Tetrao Canadensis;* Spotted Grouse, pl. 18, f. 18. *Lagopus Salicti;* Willow Ptarmagan, pl. 18, f. 17. *Pterocles arenarius;* Banded Sandgrouse, pl. 18, f. 19. *Syrrhaptes Pallasii;* Pallas's Sandgrouse, pl. 18, f. 27. *Ortyx neoxenus;* Welcome Quail, pl. 18, f. 16. *Perdix picta;* Painted Partridge, pl. 17, f. 20. *Cryptonyx coronatus;* Crowned Cryptonyx, pl. 18, f. 26. *Tinamus sylvicolas;* Barred Tinamoo, pl. 18, f. 31. *T. rufescens;* Gauza, pl. 18, f. 32. *Hemipodius tachydromus;* Andalusian Turnix, pl. 18, f. 29.

ORDER XI.—ALECTORIDES.

Bill shorter than the head, or of the same length; strong; upper mandible convex, frequently hooked at the point; tarsus long, slender, three toes before. and one behind: hallux articulated higher on the tarsus than the toes.

Psophia crepitans; Golden-breasted Trumpeter, pl. 18, f. 30. *Dicholophus cristatus;* Crested Dicholophus, pl. 15, f. 27. *Glareola isabella;* White-throated Glareola, pl. 18, f. 33. *Palamedea cornuta;* Horned Screamer, pl. 18, f. 35. *Chauna chavaria;* Faithful Jacana, pl. 18, f. 28.

ORDER XII.—CURSORES.

Bill of medium size; legs long, naked above the knee; feet with only two or three toes, directed forwards.

Struthio camelus; Ostrich, pl. 15, f. 38. *Rhea Americana;* American Ostrich, pl. 18, f. 25. *Dromiceus Novæ Hollandiæ;* Emu, pl. 15, f. 37. *Casuarius galeatus;* Galeated Casuary, pl. 18, f. 23. *Otis tetrax;* Little Bustard, pl. 18, f. 34. *Cursorius Asiaticus;* Coromandel Courier, pl. 18, f. 21.

ORDER XIII.—GRALLATORES.

Bill variously shaped, generally straight, in the form of an elongated cone, compressed, rarely depressed, legs slender, long, more or less naked above the knee; three anterior, and one posterior toe or hallux, which is united on a level with the front toes, or more elevated.

Family I.—With three toes only.

Œdicnemus crepitans; Thick Knee, pl. 19, f. 5. *Calidris arenaria;* Sanderling, pl. 19, f. 3. *Falcinellus pygmæus;* Pigmy Curlew, pl. 19, f. 9. *Himantopus nigricollis;* Black-necked Longshank, pl. 19, f. 2. *Hæmatopus ater;* Black Oyster-catcher, pl. 19, f. 4. *Charadrius vociferus;* Kildeer Plover, pl. 20, fig. 7.

Family II.—With Four Toes.

Vanellus albicapillus; White-crowned Lapwing, pl. 19, f. 1. *Stripsilas collaris;* Turnstone, pl. 20, fig. 5. *Grus torquata;* Collared Crane, pl. 20, f. 6. *Anthropoides virgo;* Numidian Crane, pl. 20, f. 1. *Aramus scolopaceus;* Scolopaceous Heron, pl. 20, f. 4. *Ardea purpurea;* Purple Heron, pl. 19, f. 6. *Ardea garzetta;* Egret, pl. 20, f. 3. *Botaurus exilis;* Least Bittern, pl. 20, f. 8. *Nycticorax violacea;* White-crowned Night-heron, pl. 20, f. 10. *Ciconia alba;* White Stork, pl. 19, f. 7. *Argala gigantea;* Gigantic Adjutant, pl. 20, f. 12. *Mycteria Senegalensis;* Senegal Jabiru, pl. 20, f. 2. *Anastomus Coromandalinus;* Coromandel Anastomus, pl. 20, f. 14. *Scopus Umbretta;* Tufted Umbre, pl. 20, f. 20. *Phœnicopterus ruber;* Red Flamingo, pl. 19, f. 8. *Recurvirostra Americana;* American Avoset, pl. 19, f. 10. *Cancroma Cochlearia;* Crested Boatbill, pl. 20, f. 11. *Platalea agaga;* Roseate Spoonbill, pl. 19, f. 11. *Tantalus loculator;* Wood Ibis, pl. 19, f. 12. *Ibis ruber;* Scarlet Ibis, pl. 19, f. 21. *Numenius phæopus;* Wimbril, pl. 19, f. 13. *Tringa alpina;* Dunlin, pl. 19, f. 14. *Totanus semipalmatus;* Semipalmated Sandpiper, pl. 19, f. 15. *Limosa fedoa;* Marbled Godwit, pl. 20, f. 17. *Scolopax Wilsonii;* Wilson's Snipe, pl. 19, f. 19. *Rynchæa variegatus;* Variegated Snipe, pl. 19, f. 18. *Eurypyga Helias;* Variegated Helias, pl. 19, f. 16. *Rallus Virginianus;* Virginian Water-rail, pl. 20, f. 19. *Gallinula Martinico;* Martinico Gallinule pl. 19, f. 17. *Parra ænea;* Bronzed Jacana, pl. 19, f. 28. *Porphyrio tavoua;* Martinico Porphyrio, pl. 20, f. 15.

ORDER XIV.—PINNATIPEDES.

Bill straight, of medium size; upper mandible slightly curved at the tip; legs middle-sized; tarsus slender, or compressed; three anterior and one hind toe, which is anteriorly articulated on the tarsus.

Fulica Americana; American Coot, pl. 19, fig. 20. *Podoa Senegalensis;* Senegal Podoa, pl. 20, f. 23. *Phalaropus Hyperboreus;* Hyperborean Phalarope, pl. 20, f. 62. *Podiceps cornutus;* Horned Grebe, pl. 20, f. 18.

ORDER XV.—PALMIPEDES.

Bill variously formed; legs short, placed more or less backwards; anterior toes wholly or partially connected by webs; in some families all the toes are united by one membrane; hallux articulated interiorly to the tarsus, or wanting in some genera.

Cereopsis cinereus; New Holland Cereopsis, pl. 20, fig. 16. *Chionis necrophagus;* White Sheathbill, pl. 19, f. 41. *Rynchops flavirostris;* Yellow-billed Skimmer, pl. 19, f. 33. *Sterna minuta;* Lesser Tern, pl. 19, f. 32. *Larus glauca;* Burgomaster Gull, pl. 19, f. 40. *Lestris Richardsonii;* Richardson's Skua, pl. 19, f. 43. *Procellaria obscura;* Diving Petrel-Puffin, pl. 20, f. 24. *Thallassidroma Wilsonii;* Wilson's Storm-Petrel, pl. 19, f. 39. *Pachyptila Fosteri;* Foster's Pachyptila. *Halidroma Urinatrix;* Diving Halidroma. *Diomedea exulans;* Wandering Albatross, pl. 20, f. 22. *Anas bochas;* Mallard, pl. 19, f. 35. *Merica Americana;* American Wigeon, pl. 20, f. 36. *Chauliodus strepera;* Gadwell, pl. 20, f. 30. *Dendronessa Sponsa;* Summer Duck, pl. 20, f. 38. *Somateria spectabilis;* King Eider, pl. 20, f. 29. *Oidemia perspicellata;* Surf Duck, pl. 20, f. 21. *Fuligula marila;* Scaup Duck, pl. 20, f. 13. *Clangula albeola;* Buffle-headed Garrot, pl. 21, f. 29; and *C. Vulgaris;* Golden-eye Garrot, pl. 19, f. 34. *Harelda glacialis;* Long-tailed Hareld, pl. 20, f. 35. *Mergus serrator;* Red-breasted Merganser, pl. 19, f. 30. *Anser Canadensis;* Canada Goose, pl. 19, f. 26. *Cygnus Bewickii;* Bewick's Swan, pl. 19, f. 25. *Pelecanus ornocrotalus;* White Pelican, pl. 19, f. 36. *Carbo graculus;* Shag, pl. 20, f. 25. *Tachypetes aquila;* Frigate Bird, pl. 20, f. 26. *Sula fusca;* Brown Gannet, pl. 19, f. 42. *Plotus anhinga;* White-bellied Darter, pl. 19, f. 31. *Phæton phænicurus;* Common Tropic Bird, pl. 20, f. 27. *Colymbus glacialis;* Great Northern Diver, pl. 19, f. 41 *Uria alle;* Little Guillemot, pl. 19, f. 23. *Phaleris cristatellus;* Tufted Stariki, pl. 20, f. 31. *Mormon fratercula;* Puffin, pl. 20, f. 9. *Alca impennis;* Great Auk, pl. 20, f. 32. *Spheniscus chrysocome;* Crested Penguin, pl. 20, f. 33. *Apterodytes Patachonica;* Patagonian Penguin, pl. 20, f. 34.

ORDER XVI.—INERTES.

Bill variously formed; body apparently thick, covered with down and feathers, with distant webs; legs placed far behind; tarsus short; three toes before, divided to the base, hallux short, articulated exteriorly; claws thick and sharp; wings not formed for flight.

Apteryx Australis; Australian Apteryx, pl, 20, f. 37. *Diau-ineptus* Dodo, pl. 20, f. 28.

orders, chelonia, sauria, ophidia, and batrachia, proposed by M. Brogniart, is adopted in both editions of M. Cuvier's work, as it was in the Tables of Classification of the Leçons d'Anatomie Comparée, in 1800. In the former edition, the class of fishes was divided into eight orders, commencing with the cartilaginous, and terminating with the osseous fishes. The same eight orders are preserved in the new edition, but their arrangement is there reversed; the cartilaginous fishes which approach nearest the mollusca, in their general characters, being placed at the bottom of the class; and this new arrangement is the same with that adopted in the great work on this class of animals, published by M. Cuvier, and M. Valenciennes. In the subdivisions of the orders, and in the distribution of the genera, many important improvements are introduced. The acanthopterygious fishes now stand at the head of the class, to which succeed the malacopterygii abdominales, malacopterygii pectorales, malacopterygii apodes, lophobranchii, plectognathi, chondropterygii branchiis apertis, and chondropterygii branchiis tectis. It is in the cartilaginous fishes belonging to the last of these orders, that we find the simplest organization, and the most imperfect form of the skeleton met with in all the vertebrate animals; and hence they form a natural link of connection between the true osseous fishes and the cephalopodous mollusca.

The first of Cuvier's divisions of invertebrate animals is divided into six classes, the most perfect of which, comprehending those mollusca most nearly allied to fishes, is termed cephalopoda. These, and the pteropoda, which compose the second class, move to and fro in the sea freely by means of membranous expansions like fins. The third class, termed gasteropoda, creep on a muscular disc or foot, placed under the belly. Those mollusca which have no distinct head, and have the mouth concealed under the mantle, as the inhabitants of bivalve shells and the tunicated animals, form the fourth class, called acephala. The animals of the fifth class resemble those of the preceding, in being enveloped in a mantle; but the mouth placed on the fore part is surrounded with long fleshy and ciliated arms, which they can extend at pleasure to seize objects: these are called brachiopoda. The last class of this great division is termed cirrhopoda, and comprehends a remarkable tribe of animals, the details of whose organization connect them much more closely with the articulated animals than with the mollusca, particularly in their possessing a double longitudinal, knotted nervous cord, and numerous articulated members. In the third great division of the animal kingdom, termed articulata, M. Cuvier has carefully drawn up, from his own observations, the account of the first class, called annelida, one of the most remarkable of the invertebrate divisions, in the animals belonging to it possessing a circulating fluid of a red colour like the blood of vertebrate animals. This small but anomalous class, was first established by M. Cuvier, in a Memoir read to the Institute of France, in December, 1801, and has since been almost universally adopted. He divided these animals into three orders, founded on characters taken from the respiratory organs. The first order, termed tubicola, have the branchiæ, in the form of small tufts, placed on the anterior part of the body, and almost all reside in tubes, like the serpula and sabella. The dorsibranchia, which form the second order, have the branchiæ in form of ramified branches, or of plates, situated on the middle, or along the sides of the body, as the common sand-worm of our coasts: these animals generally reside in soft mud, or swim freely in the sea. The last order is termed abranchia, from the animals belonging to it exhibiting no apparent branchiæ, and appearing to respire by means of the whole soft surface of their body, as the common earthworm. In placing this class of animals at the head of the articulata, M. Cuvier was probably more guided by the convenience of publication, than by the consideration of their structure, as none of them possess an organization so complicated, as that of the succeeding classes of articulate animals.

The great varieties of form and organization presented by the lowest classes of the animal kingdom, render it much more difficult to devise principles for their classification, than for the higher orders, and it is in their divisions and arrangement that we find the greatest discordance among naturalists. M. Cuvier's fourth great division of the animal kingdom, termed radiata or zoophyta, comprehends the echinodermata, entozoa acalephæ, zoophyta or polypi, and infusoria, which form the five classes of this division. In the Tableau Elementaire, the absence of the nervous system is given as a principal character of this great division, and in the Règne Animal he mentions, that when the nervous system is discernible, it is disposed in a radiated form. The nerves which have been discovered in the echinodermata and acalephæ have, however, rather a circular form, and embrace the digestive sac, and in the intestinal worms the nerves form simple longitudinal filaments. Separate sexes have been ascribed by several writers to the entozoa; but when M. Cuvier states that most of the other zoophytes are hermaphrodite and oviparous, we consider his proposition as inconsistent with the best ascertained facts, which tend to show that they are entirely destitute of sex, and are either gemmiparous or fissiparous. The echinodermata, comprehending the arterias, echinus, and similar animals, are adopted from Bruguiere, who gave them that name from the spines which usually cover their surface. To this class Cuvier added the holothuriæ which have no superficial spines, but have an internal structure similar to the other echinodermata. The intestinal worms, which form the second class of the radiated animals, Cuvier supposes to originate solely from previously existing parents by the mode of generation usual in the higher classes; while Lamarck, Meckel, and many other naturalists, believe that they may sometimes originate from the materials of the animals in which they are found. He conceives that, from the smallness of their germs, they may enter by the narrowest avenues of the body, and even be communicated to the embryos of animals before their birth. In the distribution of the entozoa, Cuvier has chiefly followed Rudolphi. The acalephæ are divided into two orders; those which have the body fixed like the actinia, and those which have it free like the medusæ. The polypi or true zoophytes are likewise divided into two orders: those which have the body naked as the hydra, and those which are provided with an axis or polyparium as the gorgonia and madrepore. The pedicellariæ, placed in the first order, appear to us to be organs of the echinus present in every individual. The property ascribed to the pennatulæ in the second order, of swimming freely by means of their contractions, and by the combined action of their polypi, is contradicted by the recent observations of Dr Grant, on these animals, and by the analogy of all the other known species of this class. The fifth class of radiated animals, and the lowest in the animal kingdom, termed infusoria, M. Cuvier has not attempted to define by their structure or form, but by their smallness; and consequently this class comprehends beings of very different organization. The first order is called rotifera, and comprehends those which have an oval gelatinous body, with a mouth, a stomach, an intestine, and an anus situate near the mouth. The genera supposed to have this complicated structure are the furcularia, tubicolaria, and brachionus. The second and only other order of the infusoria is termed the homogenea, and comprehends all those animalcules which have no internal viscera, nor other organs, and often present no appearance of a mouth. Some of these have visible external cilia, as the urceolaria, tricoda, kerona, and some others, and a second group present no external organs excepting sometimes a tail, as the cercaria, vibrio, enchelis, proteus, volvox and monas.

The whole of the divisions, and the general distribution of the animal kingdom established by M. Cuvier in this work, are founded on a more extensive and minute survey of the organization than had ever before been taken, and many of the most important distinctions among the orders and families are the result of his own researches. Where his divisions have not been adopted, the valuable and original anatomical observations contained in every part of the work have served as the bases of the new divisions proposed, and of almost all the improvements of zoological arrangement which have been introduced since the first appearance of the work. This truly useful and classical work is justly adopted as a standard of reference by the naturalists of every country, and the greater part of it has been ably translated into our language in a form suited to the importance of the great original.

The class of fishes, the most numerous of all the vertebrate division, presents the greatest difficulties to the zoologist in attempting to discover principles for their classification, from the general sameness of their form and structure, and from the few external parts which they present capable of affording characters for their distribution. This interesting class of animals long occupied the particular attention of M. Cuvier; and in the first edition of the Règne Animal, he considered his account of that class as the most important of all his contributions to the natural history of vertebrate animals. Since the publication of that work, in which Cuvier reformed almost the whole of the families and genera of fishes, immense accessions have been made to the ichthyological part of the Paris Museum, by travellers and navigators in all parts of the globe, and many valuable contributions have been added to ichthyology by the writings of naturalists in different countries. When M. Cuvier first left his native country, in 1788, and resided with a French family, in a pleasant retreat on the coast of Normandy, he dissected, described, and drew almost all the fishes met with on the coast of La Manche. While engaged in organizing the Royal College of Marseilles, in 1803, he occupied his leisure hours in examining the ichthyology of that part of the Mediterranean; and when engaged many years afterwards on a similar mission in the Italian States, he continued his ichthyological inquiries at Genoa and other parts of the coast of Italy. It is chiefly, however, from the vast ichthyological treasures of the natural history museum of Paris, accumulated for more than half a century, from every part of the globe, and which were liberally submitted to his examination, that M. Cuvier derived the materials of his work. When M. Cuvier and M. Valenciennes first undertook to publish a complete history of that class of animals, it was calculated that the work would extend to about twenty volumes octavo, and would embrace the history of five thousand species. Although the work is the joint production of the two authors, the parts contributed by each are regularly pointed out in the list of the species contained in each volume.

The first volume contains the fullest account of the progress of ichthyology from the earliest period to the present times, which has yet appeared, and interesting biographical notices of all the authors mentioned are given in the form of notes. In the view of the distribution of the class of fishes, with which the first volume terminates, they are divided into osseous and cartilaginous. The osseous fishes are divided into those which have the branchiæ of a pectinated form, or in plates; and those which have them in form of tufts, as the hippocampus. The osseous fishes, with pectinated branchiæ, are divided, in the same binary mode, into those which have the upper jaw free, and those which have the same part fixed. Those with the upper jaw free are the acanthopterygious and malacopterygious divisions, and those with the jaw fixed form an order, which is thence called plectognathi. The great division of cartilaginous fishes is divided into three families, sturionii, plagiostomi, and cyclostomi. From the extreme difficulty of establishing well-marked subdivisions throughout the class, M. Cuvier here principally relied on the more convenient divisions of families, of which he has enumerated twenty-eight as calculated to contain all the known genera and species of fishes. Although the division of this class into orders well marked, proportionate, and convenient, is very far from being yet attained, the anatomical details of M. Cuvier regarding this class, may be considered as the most important step which has ever been made towards attaining that object, as they form the best contribution which has yet been made to this branch of comparative anatomy.

The cartilaginous fishes form a very distinct and convenient division of the class, presenting obvious characters, and comprehending only about a tenth part of the known species; but the division of the rest of the class into two parts, founded on the structure of the fins, which are soft and supported by branched and articulated rays in the malacoptergygii, and are stiff and in part supported by undivided sharp osseous spines in the acanthopterygii, is too general to serve for their distribution into orders. M. Cuvier, impressed with the great importance and value of these characters of Artedi, and disregarding all the attempts made by Ray, Linnæus, Gouan, Pennant, Lacepede, Dumeril, Risso, Goldfuss, and other naturalists, to establish inferior divisions founded on the general form of the body, on the position or absence of fins, or on the absence or nature of the operculum, entirely overlooked the usual method of zoologists, of distributing all the genera into appropriate and well-defined orders, and only attempted to subdivide the great primary divisions of the class into numerous natural families.

The acanthopterygious fishes, which compose nearly three fourths of the known species, are divided into numerous subordinate groups, formerly regarded as genera, so intimately related to each other, and connected by transitions so imperceptible, that the whole may be regarded as an immense natural family, which cannot at present be disunited without losing sight of their most important relations. These subordinate groups are the natural families which Cuvier preserved, assigning to each more definite characters, and preserving for it the name by which its principal genus is designated. It was in 1828, that the first and second volumes of the great work on ichthyology appeared. Meanwhile Cuvier had been advancing in honours and places under the Bourbons, though not perhaps so rapidly as if Napoleon had still been the ruler of France, on account of the religion to which he steadily adhered. In 1818 Louis offered him the ministry of the Interior, but he thought proper to decline it. At that period he made his first visit to England, an occurrence of which he delighted to converse, and the animated recollection of which seemed to be always fresh in his memory. It was also in 1818 that he was elected member of the Académie Française, and his discourse on his reception was remarkable for its extreme beauty and elegance. The university of Paris had to struggle with many obstacles to its welfare; each religious party tried to gain entire possession of it; the grand masters were never long in place; and the difficulty of selecting others was consequently considerable. In two of these intervals M. Cuvier acted the part of grand master till another could be found, and he first held this temporary office in 1819, at which time he was also appointed president of the Comité de l'Intérieur, and created a baron. In the following year he gave up the grand mastership, only to resume it in 1822, when he finally resigned it, and a new place was made, which he filled to the hour of his death; viz., grand master of all the faculties of Protestant theology. In 1824 as president of one of the councils of state he assisted at the coronation of Charles X., on which occasion he was made grand officer of the legion of honour, and commander of the order of the crown, by the king of Würtemberg. In 1827, when parties were running high, and Charles X. was pursuing the system of government which finally led to his own expulsion, M. Cuvier was appointed censor of the press. But the duties attached to the office were too odious to his feelings, and he firmly and decidedly refused the appointment, though by so doing, he risked his other places, and made himself liable to a comparative poverty. He was, however, charged after this with the administration of all the non-Catholic religions in France. In 1828, besides the two volumes on ichthyology, he published the Latin notes and annotations on Pliny's Natural History, and it was also in this same year that the severest calamity which could befal a parent, gave a different colouring to his feeling, and tinged the whole of his after-life with sadness: this was the death of his daughter, the only surviving child of four. Mademoiselle Cuvier died of rapid consumption, a few days after that which had been appointed for her marriage. This gifted creature had been the light and joy not only of his existence, but of all round her; so talented, so excellent, so beautiful, and so affectionate, that it was no wonder that the mighty heart which had withstood all else with firmness, was torn asunder by her loss; Cuvier secluded himself for a time, but roused to a sense of his duties by a consciousness of their importance, he worked harder than ever, hoping by this means to cure a wound which never healed. The affectionate cares of his admirable wife and step-daughter were if possible increased; and he returned their devoted affection with interest. It was perhaps owing to their efforts, that he was enabled to pursue his studies; a proof of which perseverance came out in 1829, in the form of a second edition of the Règne Animal, containing various modifications and additions, so as to bring it on a level with the latest discoveries. To this succeeded the third and fourth volumes of his Ichthyology. In 1830 he resumed his lectures at the Collège de France, published volumes five and six of the Ichthyology, and in a short interval of relaxation, paid a second visit to England. He had long received permission to do so from his sovereign, a permission which, from the multitude and importance of his places, it was not only difficult to obtain, but still more so to enjoy; delays had taken place in consequence of some affairs at the Institute, so that by chance he started precisely on the morning of that day, in which the last revolution in France was declared. He had rejected every idea of any serious outbreaking of the spirit of discontent, which the famous ordonnances had evidently stirred up; he was of opinion, that it was a chronic malady which would take time to cure, and leaving his wife under the care of her only surviving son and family, he departed wholly unconscious of the projected explosion. No certain intelligence of the great change reached him until he arrived at Calais, where he remained in order to receive from the capital news on which he could rely. That he could not return with papers signed by Charles X., was very evident, and when Madame Cuvier wrote to him that peace was restored, but that all was uncertainty, he proceeded to England. The good people of this country could scarcely be convinced that he had not purposely fled from Paris to avoid the loss of his head; but Cuvier had nothing to fear, and the simple fact that he had left his wife behind, was quite sufficient to disprove to all who knew him, any thing like intentional absence on his part during this revolutionary storm. A diplomatist can scarcely find credit when he makes a straightforward statement; and the circumstances being of so suspicious a nature, the scientific views with which M. Cuvier really came to this country were thought to be a mere pretext. Accordingly he was assailed by condolences and compassion, which he received with surprise and almost amusement. He was, however, uneasy because he was not on the spot, and instead of remaining six weeks as he intended, he quitted London at the end of a fortnight. In 1831 appeared the seventh and eight volumes of his Ichthyology; in 1832 he was created a peer, was made president to the entire council of state, re-opened his course of lectures at the Collège de France on the history and progress of science, delivered the most impressive and remarkable introductory discourse which had ever saluted the ears of his audience, was seized with paralysis the same evening, and after five days' struggle, closed his earthly labours.

The most important feature in natural history in the present time is—the endeavour, now made almost universally, to refer the affinities of animals to some fixed principles of arrangement,—some general plan determined by certain laws. We can hardly doubt of there being such a plan, upon which the great Author of nature has formed the innumerable creatures which people the earth. When we see the harmony which pervades the rest of his works;—when we become acquainted with the beautiful laws which have been discovered in other sciences;—when, especially, we call to mind the principles established in those which border most closely upon zoology;—we can hardly but conceive, that this science also admits of some generalizations, and that animals are as much under the influence of given laws in respect to their affinities, as they are in respect to their structure. Now it may be true that the first idea of the existence of such a plan belongs to a much earlier period than the present; and that Linnæus, and even the older naturalists, had some faint notions upon this subject; but, until the close of the last century, there was hardly any attempt made to elucidate its principles; and only quite recently has this attempt, with some few exceptions, become general. The reason is obvious. The science had not made sufficient progress to warrant the endeavour. And for the same reason, it is obvious we must await the arrival of many years to come before we can hope to see that endeavour perfected. We are not, then, surprised to find, that although naturalists are everywhere pursuing the same object, they are following very different roads in the hope of attaining it. We should wonder if it were otherwise. When we think of the immense field which zoology lays before us,—of the comparatively small portion of that field as yet explored,—and of the impediments which arise to make our path difficult;—when we reflect further, how much is required to determine the exact relations of a single group,—and how often we are left to mere conjecture and analogy, in the absence of facts, which can alone establish our reasonings on a sure basis;—we are prepared to meet with much variety of opinion upon such a subject. It is, indeed, more than probable that the classification of animals is destined yet to undergo, at least in part, great and important changes.* The views of naturalists will differ, according as they have paid most attention to this or that department of the science, in each of which, from the unequal progress of our knowledge, we appear to recognize the influence of distinct principles. Their minds, too, will receive, unconsciously to themselves, a slight bias, arising from the nature of their other studies, or of those which led them to the particular study of which we are here speaking. It is only time which can do away with the erroneous conclusions of a partial or a prejudiced judgment. Contrariety of opinion originating in the above sources, is for a season unavoidable; and we must wait patiently till we have received sufficient light to determine those questions, with respect to which naturalists are so much at issue.

But independently of what has been above-mentioned, there is another and distinct ground of difference observable in the attempts which have been made of late years to arrange animals upon some uniform plan. In fact, there are two distinct principles upon which we may proceed, each being in accordance with certain obvious relations existing in nature. We may either take for our guide the principle of the subordination of characters, successively grounding our divisions upon modifications of structure becoming less and less important as we proceed downwards; or we may seek to distribute animals into as many principal groups as there are well-marked series, each of these series being characterized by a peculiar type of organization gradually becoming more and more simple in its descent. The former of these principles is that which was first developed, and so strenuously upheld, by the great Cuvier, and which is still adhered to by a large proportion of the naturalists in France and in our own country. The latter may be distinguished in many of the systems which have appeared in Germany, as well as in some which have emanated from other quarters. It may be said, that, as there can be but one natural system, strictly speaking, it is impossible that both these principles can conduct to true results. This would be correct if animals exhibited only one *kind* of relation to each other. But we know that they exhibit more than one; and hence, we are not without hope, that, notwithstanding the opposite nature of these principles, the day may come, in which it will be found possible to reconcile the views to which they have respectively given birth. Some slight approach to this reconciliation already shows itself in the theories of those naturalists who distinguish between *relations of affinity* properly so called, and *relations of analogy*. It does not follow, that the theories themselves, by which it is attempted to explain these relations, and to refer them to given laws, are necessarily correct. Which, or whether any, of them can be so regarded, is a matter for time to determine. We would here simply draw attention to a point which may hereafter prove in some measure a bond of union between two conflicting opinions of the present day, and conduct at length to truths of which it will be then found that each party had some faint glimmerings.

---

* We may mention in this place, that a new arrangement of the Animal Kingdom has been recently brought forward by Professor Ehrenberg of Berlin. It is divided into 29 classes, founded on the organization, and on the general existence of one type of structure, as respects the system of sensation, circulation, locomotion, nutrition, and reproduction.—See L'Institut, 1835, p. 305.

Notwithstanding the diversity of their views respecting the details of systematic arrangement, —there may often be observed certain features of resemblance (not of identity) in the general principles from which naturalists set out. This resemblance may be especially traced in two very different schools established in Germany and in our own country respectively. Thus, for instance, the principle first laid down by Oken, that the classes of the animal kingdom are severally characterized by the particular development of some one of the animal functions, and that these characters are continually reproduced in the subordinate divisions, causing each group to contain representations of those above it, together with its own peculiar type;—this idea offers some analogy to the "Theory of Representation" of Mr Swainson,* which is itself only an extension of one of the views adopted by Mr Macleay.†—We may also refer to the idea, that the subordinate divisions of every natural group are controlled by some fixed number,—as another point of resemblance in the two schools. This principle, indeed, seems to follow from the one just mentioned as a necessary consequence, since if two groups do not contain exactly the same number of divisions, it is impossible that the larger number can be all duly represented by the smaller.

That animals do appear, in a multitude of instances, to represent, as it were symbolically, others, with which they are connected by no immediate affinity, must have struck the most inattentive observer. It is also in the highest degree probable, that these relations, as well as all others, are in accordance with some fixed laws. But whether these laws will be found in the end exactly as they are laid down by either of the parties above referred to,—whether by making some slight modification in either of their peculiar theories, or by combining their principles in any manner,—we may be able to attain ultimately to some result, not very different from the results at which they have respectively arrived;—these are questions, which, as we said before, time only can determine.

---

* Faun. Bor. Am. part 2, p. xlviii.; and Classification of Animals, p. 236.

† Horæ Entomologicæ, part 2, p. 518.

GENERAL INDEX OF PLATES.

The extremely popular character of Goldsmith's Natural History, divested as it is of all systematic formality, prevented the Editor of the present edition from identifying the Engravings, in all their details, with the Text of the work, or even with the copious Notes that have been appended to every page. And though scientific classifications, immediately referring to the Plates, are introduced at suitable intervals, some little difficulty may still be experienced, by those unacquainted with the technical and scientific arrangements of Natural History, in obtaining the information they desire regarding the various figures illustrated. To remedy apparent deficiencies, and to supply some few omissions which have occurred during the progress of the work, it has been deemed advisable to give a General Index of Plates, in which every figure is named, and referred either to a particular description in the Text or Notes, or to the page where it finds place in a scientific classification. From the peculiar nature of this work, it sometimes happens that a figure is necessarily referred to a portion of the text which treats of the *species*, but which does not include the *individual* illustrated; in all cases, however, where it appeared requisite to do so, particular descriptions have been introduced into the Index, imbodying all necessary information. It is scarcely necessary to observe that several of the Plates, such as those referring to *Paleontology*, *Mollusca*, *Polypi*, &c., are immediately connected with abstruse departments of Natural History which have not yet assumed a popular form, and that therefore, the information regarding them must necessarily be technical and limited. As, however, the Plates and numerous Woodcuts thoroughly illustrate the popular portion of our subject, it will form no objection to the work that the Engravings include a variety of figures of more abstruse details, which, indeed, can only be understood through the medium of a pictorial illustration, and concerning which we can give little information beyond what the figure itself conveys.

PLATE I.—NATURAL SCENERY AND PHENOMENA.

Volcano—Mount Vesuvius in eruption, p. 41–44, i.
Simoom—the Sand-storm of the Desert, p. 10, 11, 126, i.
Cataract—Niagara—The Horse-shoe Fall from below the Tower, p. 81, 82, i.
Boiling Spring—The Great Geyser—Iceland, p. 42, 67, i.
Iceberg—Icebergs seen near Kosoak by Dr. Kane, p. 88, 89, i.
Glacier—The Glacier of Bossons, valley of Chamouni, p. 64, 65, i.

PLATE II.—THE PRINCIPAL GEOLOGICAL FEATURES OF EUROPE.

This plate is referred to in the notes on p. 17–30, i., and in the text connected with them.

PLATE III.—GEOLOGY.

This plate, in a series of eight vignettes, exhibits some remarkable natural phenomena connected with geological science. They refer to and illustrate the introductory chapters in vol. i.

PLATES IV. AND V.—PALEONTOLOGY.

These plates illustrate the fossil remains enumerated in note to p. 23, i.; the numbers of the **figures on them** are continuous.

PLATE VII.—MAN.

P. 213, 214, Vol. i.

Fig.
1 Georgian.
2 Armenian.
3 Tscherkassan.
4 Circassian.
5 Cabardiner.

Fig.
6 Tschetschenzen.
7 Cossack of the Don.
8 Cossack of the Ural.
9 Esthonian.
10 Moldavian.

Fig.
11 Finn.
12 Arnaut.
13 Arabian.
14 Mameluke.
15 Mameluke.

Fig.
16 Copt.
17 Turk.
18 Egyptian.
19 Persian.
20 Hindoo.

PLATE VIII.—MAN.

P. 214, Vol. i.

Fig.
1 Yakoute.
2 Ostiak,
3 Kalmuc.
4 Kirghises.
5 Kasanian.
6 Mongol.

Fig.
7 Tomsk Tartar.
8 9 10 Chinese.
11 12 Japanese.

Fig.
13 14 15 16 Kamtschadales.
17 Prince William's Sound.
18 Nootka Sound.

Fig.
19 Maxuruna. **Leader of one of the wild tribes on the frontiers of** Peru.
20 Tajadaneega. **General** of the Mohawks.

PLATE IX.—MAN.

P. 214, Vol. i.

Fig.
1 Samoyede.
2 3 4 5 Brazilian Botokuden.
6 Brazilian Camakans.

Fig.
7 Brazilian Puris.
8 Brazilian Padachos.
9 10 10 Hottentots.

Fig.
11 Hottentot.
12 13 14 15 Bushmen.

Fig.
16 *a. b. c.* Papuas of Van Diemen's Land.
a. Grou-Agara.
b. Ara-Meida.
c. Para-Beri.

PLATE X.—MAN.

P. 214, Vol. i.

Fig.
1 2 3 4 Negroes (proper).
5 *a. b. c.* Papuas of New Holland.

Fig.
a. Kour-Nou-Bari-Gat.
b. Y-Erran-Gou-la-ga.
c. Quire-Kine.
6 Tatowirter. Warrior of Nuka-hiwa.
7 Fox Island.

Fig.
8 9 New Zealanders.
10 11 Inhabitants of Onalashka.
12 13 Inhabitants of Sandwich islands.

Fig.
14 Tammeamea, prince of the Sandwich islands.
15 Naba-Seba, prince of the Timor island.
16 Otaheitan.

MAMMALIA.—PLATES XI. XII. XIII. XIV.

ORDER I. BIMANA.—See p. 213—217, Vol. i.

ORDER II. QUADRUMANA.

Quadrumanous animals have three kinds of teeth; incisors, canines, and molars; all the four extremities are provided with hands, which fit them in an especial manner for climbing trees. The thumb, however, differs from that of man, being not opposible; pectoral mammæ two or four. Their food consists of fruits, roots and insects.

FAMILY I. SIMIÆ.

Form approaching that of man; two pectoral mammæ.

Chimpanzee, pl. 12. f. 1.
Orang-outang, pl. 12. f. 2.
Siamang, pl. 12. f. 9.
Capped Monkey.
Full bottomed Monkey, pl. 11. f. 40.
Proboscis Monkey, pl. 13. f. 44.
Douc, pl. 11. f. 34.
Entellus Monkey, pl. 12. f. 4.
Skull of S. maurus, pl. 11. f. 22.
Varied Monkey, pl. 12. f. 5.
White-eyelid Monkey, pl. 12. f. 6.
Black Ape, pl. 12. f. 7.
Black Baboon, pl. 11. f. 35.
Rib-nose Baboon, pl. 12. f. 8.

AMERICAN MONKEYS.

The Coaita, pl. 13. f. 36.
Capparo, pl. 13. f. 37.
Araguato, pl. 13. f. 38.
Horned Sapajou, pl. 12. f. 10.
Siamiri, pl. 13. f. 39.
Douroucouli, pl. 12. f. 11.
Cacajao, pl. 12. f. 12.

FAMILY—OUISTITI.

Striated Monkey, pl. 13. f. 52.
Silky Tamarin, pl. 11. f. 41.

FAMILY II. LEMURS.

Form approaching quadrupeds; incisory teeth varying in form and number; nostrils placed at the extremity of the muzzle; first finger of the lower extremities next the thumb, with a sharp turned up nail.

Short-tailed Indris, pl. 13. f. 42.
Otalicnus Senegalensis, pl. 11. f. 29.
Fleecy Indris.
Ruffled Lemur, pl. 12. f. 13.
Slender Loris, pl. 12. f. 14.
Slow Lemur, pl. 13. f. 43.
Senegal Galago, pl. 12. f. 15.
Banca Tarsius, pl. 13. f. 45.
Aye-Aye, pl. 13. f. 41.

ORDER III. CARNASSIERS.

Three kinds of teeth, the molars formed for cutting merely; the jaw capable of a vertical motion only; the thumb of the anterior feet, never opposible to the fingers.

FAMILY I. CHEIROPTERA.

Fingers connected by a membrane, extending from the anterior to the posterior hands, answering the purpose of wings. Incisors varying in number; canines rather strong; molars with acute crowns.

TRIBE I. GALEOPITHECI.

Nails of fingers long and greatly hooked; skin of the membranes hairy on both sides.

Colugo, pl. 12. f. 16.

The following arrangement of the Bats is proposed by Mr. J. E. Gray.

TRIBE II. VESPERTILIONES.

Sub-Family. Rhinolophinæ.

Nasal appendages membranous, complicated; index finger consisting of one joint.

Larvatus, pl. 13. f. 47.

Sub-Family. Phyllostominæ.

Nasal appendage simple, fleshy, entire or double; index finger formed of two phalanges.

Javelin Bat.

Sub-Family. Pteropinæ.

Molars obtusely tubercular; wings conical; interfemoral membrane and tail usually wanting; index finger with three joints; head elongated, hairy.

Pteropus Javanicus, pl. 13. f. 46.

Sub-Family. Noctilioninæ.

Molars acutely tuberculated; wings long, narrow; index finger two-jointed; head short, obtuse; lips very large; tail incurved.

Noctilio Braziliensis, pl. 12. f. 17.

Sub-Family. Vespertilioninæ.

Molar teeth acutely tubular; wings large, broad; index finger of only one joint; head long, hairy; lips simple; tongue short; tail long.

Vespertilio murinus. Common bat, pl. 12. f. 18.

ORDER IV.

FAMILY I. INSECTIVORA.

Molars having various sharp points; in some species the canines are very long, and in others short; teats ventral, sometimes both ventral and pectoral; legs short, always formed for plantigrade locomotion.

Common hedge-hog, pl. 12. f. 19.
Shrew mouse, pl. 12. f. 20.
Pyrenees desmary, pl. 12. f. 21.
Tana Tupaia, pl. 13. f. 49.
Canadian scalops, pl. 12. f. 24.
Indian chrysochloris, pl. 12. f. 22.
Common mole, pl. 12. f. 23.
Tenrec, pl. 12. f. 25.
Radiated condylura, pl. 13. f. 18.

FAMILY II. CARNIVORA.

Each jaw provided with six incisors; molars devoid of sharp points; canines long and strong.

TRIBE I. PLANTIGRADES.

Predatory animals; their whole foot from toe to heel placed on the ground while walking.

North American bear, pl. 12. f. 26.
Racoon, pl. 12. f. 27.
Brown coati, pl. 12. f. 28.
Potto, pl. 12. f. 29.
American badger, pl. 12. f. 30.
Teledu, pl. 13. f. 48.
Wolverene, pl. 12. f. 31.
Ratel.

TRIBE II. DIGITIGRADES.

Predatory animals, which walk on their toes only.

1*st Sub-division.*—With tuberculous tooth behind the great carnivorous tooth of the upper jaw.

Canada martin, pl. 12. f. 32.
American skunk, pl. 12. f. 33. Variety of ditto the Chince, pl. 12. f. 34.
Pondicherry otter, pl. 12. f. 35.
Sea otter, pl. 11. f. 36.

2*nd Sub-division.*—Having two tubercular teeth behind the great canine one in the upper jaw.

English pointer, pl. 13. f. 57.

1. Pupils of the eyes circular.

Section I. Head elongated; parietal bones imperceptibly shelving towards each other; condyles of the under jaw parallel with the upper molars. Australian dog, greyhound, &c.

Section II. Head moderately elongated; parietals approaching each other from their insertions, but slightly divergent. Spaniel, shepherd's dog, &c.

Section III. Muzzle more or less truncated, cranium considerably elevated; condyles of the lower jaw placed above the line of the upper molars. Bull dog, mastiff, wolf, &c.

2. Pupils of the eyes long; tail long and bushy. Foxes.

Fulvous fox, pl. 13. f. 59.
Hyena dog, pl. 11. f. 39.
Smith's fennec, pl. 11. f. 37.
Civet, pl. 12. f. 36.
Type paradoxurus, pl. 12. f. 37.
Steedman's cynictis.
Gray ichneumon, pl. 13. f. 19.
Cape Suricate, pl. 12. f. 38.

3*rd Sub-division.*—Of Digitigrades destitute of a tubercular tooth behind the large canine one in the under jaw.

Spotted Hyæna, pl. 13. f. 53.
Clouded Tiger, pl. 13. f. 58.

FAMILY III. AMPHIBIA.

Feet enveloped in the skin, short, fine shaped, and adapted for swimming, hind feet placed horizontally; incisors generally $\frac{4}{4}$ $\frac{6}{4}$ $\frac{4}{2}$.

Common Seal, pl. 13. f. 63.
Proboscis Seal.
Sea Bear, pl. 13. f. 65.
Walrus, pl. 13. f. 64.

ORDER V. MARSUPIALIA.

Teeth of the various sub-divisions differing considerably; young produced in an imperfect state, and are matured in an external pouch, which is supported by two marsupial bones; thumbs of hind extremities, mostly distinct and opposable to the fingers, in most species.

1*st Sub-division.* — With canines and insectivorous cheek teeth.

Virginian Opposum, pl. 12. f. 39.
Yapock, pl. 13. f. 55.
Spotted Dasyurus, pl. 13. f. 56.
Raffles' Gymnura, pl. 13. f. 20.
Long Nosed Perameles, pl. 13. f. 54.

2*nd Sub-division.*—Incisors $\frac{6}{2}$, lower ones very long; canines in lower jaw, very small or none.

Cook's Phalanger, pl. 13. f. 21.
Flying Petaurista, pl. 14. f. 25.

3*rd Sub-division.*—Incisors $\frac{6}{2}$; the lower ones very long and shelving; canines $\frac{0}{1}$ $\frac{0}{1}$.

Kangaroo Rat, pl. 13. f. 23.
Large Kangaroo, pl. 12. f. 40.
Koala, pl. 12. f. 41.

4*th Sub-division.*—Incisors $\frac{2}{2}$; no canines.

Wombat, pl. 12. f. 42.

5*th Sub-division.*—Not marsupial.

White-faced Arctictes, pl. 11. f. 30.

ORDER VI. RODENTIA.

Each jaw provided with two large incisors, separated from the molars by an open space; destitute of canine teeth; lower jaw articulated by a longitudinal condyle, orbits not separated from the temporal fossæ; the Zygomatic arches small; toes varying in number. Cutting teeth of a rodent, pl. 11. f. 19.

Section I. Provided with Clavicles.

Beaver, pl. 12. f. 43.
Ondatra, pl. 13. f. 25.
Water Campagnol, pl. 12. f. 49.
Hairy Sigmadon, pl. 11. f. 17.
Drummond's Neotoma, pl. 13. f. 26.
Florida Neotoma, pl. 13. f. 6.
Prickly Sigmadon, pl. 11. f. 14.
Lapland Lemming, pl. 13. f. 27.
Rough-haired Echimys, pl. 13. f. 12.
Common Dormouse, pl. 13. f. 13.
Coypou, pl. 13. f. 9.

1st Sub-division. Spineless rats of the old Continent.

Field Mouse, pl. 13. f. 40.

2nd Sub-division. Destitute of spines. American Rats.

Red Rat.

3rd Sub-division. Spinous Rats.

Perchal Rat, pl. 13. f. 10.
Common Hamster, pl. 12. f. 44.
Douglas's Geomys, pl. 11. f. 44.
Douglas's Camas Rat, pl. 13. f. 29.
Jerboa, pl. 13. f. 22.
Labradore Sweeping Mouse, pl. 13. f. 5.
The Spalax, pl. 13. f. 4.
Coast Bathyergus, pl. 13. f. 1.
Cape pedetes, pl. 13. f. 3.
Alpine Marmot, pl. 13. f. 7.
Franklin's Marmot, pl. 12. f. 45.
Fournier's Capromys, pl. 13. f. 8.
Chickasee Squirrel, pl. 12. f. 46.
Lesser American Flying Squirrel, pl. 14. f. 10.

Section II. With imperfect clavicles, or none.

Crested Porcupine, pl. 12. f. 50.
Fasciculated Porcupine, pl. 14. f. 13.
Chinchilla, pl. 13. f. 11.
Rabbit, pl. 13. f. 15.
Pika, pl. 13. f. 14.
Capybara, pl. 12. f. 47.
Guinea Pig, pl. 13. f. 16.
Agouti, pl. 13. f. 17.
Brown Paca, pl. 13. f. 50.

ORDER VII. EDENTATA.

Destitute of incisors in either jaw; sometimes having molars only; some species are altogether without teeth; the toes variable in number, and protected by strong nails.

Tribe I. Tardigrada.

Face short, with canines and molars, or with the latter only; nails long, bent.

Three-toed Sloth, pl. 14. f. 8.
Cuvier's Megathurium.

Tribe II. Effodientia, or digging Edentata.

Muzzle generally elongated; with molar teeth only, sometimes none.

Nine-Banded Armadillo, pl. 14. f. 7.
Cape Ant-Eater, pl. 13. f. 31.
Great Ant-Eater, pl. 14. f. 6.
Indian Manis, pl. 13. f. 28.
Truncated Chlamyphorus, pl. 13. f. 2.
Spiny Echidna, pl. 13. f. 60.
Duck-billed Platypus, pl. 13. f. 61. The Bill is represented pl. 52. f. 49; a fore foot, f. 47; and a hind foot, f. 31.

ORDER VIII. PACHYDERMATA.

Thick skinned animals, with three kinds of teeth, feet provided with toes, variable in number, and terminated with strong nails or hoofs, destitute of clavicles.

Family I. Proboscidea.

Upper incisors in the form of tusks; molars compound, few in number; five toes on all the feet; provided with a proboscis.

Indian Elephant, pl. 14. f. 1.
African Elephant, pl. 14. f. 2.
Mammoth, pl. 11. f. 42. Found fossil only, in North America. Grinder of Mammoth, pl. 11. f. 16.

Family II. True Pachydermata.

Mostly with three kinds of teeth, two at least, in others feet with four or two toes.

Hippopotamus, pl. 12. f. 48.
Domestic Hog, pl. 13. f. 34.
Æthiopian Boar, pl. 13. f. 35.
Collared Peccary, pl. 14. f. 3.
Greater Anoplotherium, pl. 52. f. 43; and skeleton, pl. 4. f. 20. Found in a fossil state only.
Indian Rhinoceros, pl. 14. f. 5.
Cape Hyrax, pl. 14. f. 4.
The Little Palæotherium, pl. 4. f. 38.
American Tapir, pl. 14. f. 16.

Family III. Solidungula.

With three kinds of teeth; only one visible toe, and a strong hoof on each foot.

Ass, pl. 13. f. 32.

ORDER IX. RUMINANTIA.

With three kinds of teeth, but destitute of incisors in the upper jaw; without clavicles; feet with two-hoofed toes; metacarpal and metatarsal bones united; organs of digestion calculated for ruminating, and consisting of four stomachs; they feed on vegetables; and embrace a wide geographical range.

Tribe I. Camelidæ.

Feet with horny soles; canines in both sexes; no horns.

Bactrian Camel, pl. 13. f. 62.
The Lama, pl. 13. f. 51.

Tribe II. Cervidæ.

Feet bisulcated; no horns; males with canines in the upper jaw.

Thibet Musk, pl. 14. f. 12.
Nepaul Stag, pl. 14. f. 11.
Elk.
Roebuck.
Brocket.
Muntjak.

Tribe III. Giraffidæ.

Frontal process prolonged in the form of horns, covered with a hairy skin in both sexes.

Giraffe, pl. 14. f. 9.

Tribe IV. Capridæ.

Horns persistent, sheathing upon an osseous nucleus, nearly solid, receiving its increase by annual rings at the base.

Chamois, pl. 14. f. 15.

The following subgenera are proposed by Major Hamilton Smith:—

Prong-horned Antelope.
Blue Antelope.
White Oryx.
White-faced Gazelle.

Division II.

Horns in the male only.

Common Antelope.
Cream-coloured Antelope.
Steenbock.
Sharp-horned Antelope.
Four-horned Antelope.
Four-tufted Antelope.

(Order IX. Ruminantia. Continued.)

Salt's Antelope.
Harnessed Antelope.
Duvanceli's Antelope.
Ovine Antelope.
Wool-bearing Antelope.
Anoa.
Domestic Goat, pl. 14. f. 14.
African Sheep, pl. 14. f. 18.

The four following are sub-genera, according to Major Hamilton Smith:—

Bubalis.
Impoofo.
Koodoo.
Neel Ghau.

Tribe V. Bovidæ.

Horns (in both sexes) persistent, round, smooth, never straight, and invariably placed upon the sides of the frontals; muzzle broad; females with an udder; stature large; gregarious.

Gnu.
Musk Ox, pl. 13. f. 33.
American Bison, pl. 14. f. 17.

Major Smith gives the following as sub-genera:—

Cape Ox.
The Bison.
Urus.
Anoa depressicornis.

ORDER X. CETACEA.

Body formed like a fish, terminated by a cartilaginous caudal appendage placed horizontally; two anterior extremities formed like fins; teeth conical or none; skin smooth, entirely destitute of hair.

Family I. Sirenia.

Herbivorous Cetacea.

Senegal Manatus, pl. 14. f. 21.
Dugong, pl. 14. f. 19.
Northern Stellerus.

Family II. Cetacea.

Teeth conical, or none; nostrils assuming the form of spiracles; skin smooth, shining, and destitute of hairs on every part; mammæ placed near the anal opening.

Porpoise, pl. 14. f. 22.
Narwal, pl. 14. f. 20.

Tribe II. Large-headed Cetacea.

Great-headed Cachalot, pl. 14. f. 24.
Common Whale, pl. 14. f. 23.

PLATE XI.—MAMMALIA.

Fig.
1 Cranium of the Caucasian, p. 217, i.
2 Coronal surface of do., p. 217, i.
3 Cranium of the Mongolian, p. 217, i.
4 Do. Ethiopian, p. 217, i.
5 Coronal surface of do., p. 217, i.
6 Cranium of an Ancient Greek, p. 217, i.
7 Incisory Tooth of Man.
8 Canine Tooth of Man.
9 Molar Tooth of Man.
10 Incisory Tooth of a Lion.
11 Canine Tooth of a Lion.
12 Molar Tooth of a Lion.
13 Skeleton of a Monkey.

Bones of the Trunk.

a.	The Sternum, or breast bone.
BB.	The seventh or last true rib.
c.	The cartilage of the ribs.
DD.	The twelfth, or last of the five false ribs.
EE.	The lumbar vertebræ, with their intervertebral cartilages and transverse processes.
f.	The os sacrum.
G.	The os innominatum, composed of the os ilium A, os pubis X, and the os ischium *b*.

Bones of the Superior Extremity.

H.	The clavicle fixed before to the first piece of the sternum, and outwards to the acromium of the scapula 1.
C.	The scapula: above it is the cervix of the scapula, and below the outward extremity of the clavicle, the superior costa, and coracoid process are seen.
KK.	The os humeri.
6.	The head, or ball of the os humeri: on each side are seen the internal and external tubercles of the os humeri, and farther out, the groove for lodging the tendon of the long head of the biceps muscle.
7.	The inner condyle of the os humeri.
8.	The outer do.
LL.	The radius, at the end of which is its head.
MM.	The ulna, at the upper end of which is the coronoid process.
QQ—QQ.	Bones of the carpus, eight in number.
NN.	The metacarpal bone of the thumbs.
PP.	The metacarpal bones of the fingers.
qa—qa.	The two bones of the thumbs.
RR—R.	The three phalanges of the fingers.

Bones of the Inferior Extremity.

S.	The os femoris, the ball or head of the bone is lodged in the acetabulum.
13.	The cervix of the bone.
14.	The large trochanter.
15.	The small trochanter.
16.	The inner condyle.
T.	The patella, placed upon the trochlea of the os femoris.
U.	The tibia.
17.	The head of the tibia.
18.	The tubercle of the tibia.
19.	The malleolus internus.
V.	The fibula, the upper end of which is connected with the tibia.
20.	The malleolus externus.
WW.	The bones of the tarsus.
21.	The projection of the os calcis.
XX.	The metatarsal bones of the four toes.
YYYYY.	The phalanges of the toes, or of the lower hands in monkeys and other quadrumanous animals.
22 22.	The pelvis.
zz.	The vertebræ of the tail, or caudal vertebræ. This organ in man consists but of a single bone rising out of the lower part of the pelvis, and is termed the os coccygis, f. 27.

Fig.
14 Jaws of the Prickly Sigmadon.
15 Molar Teeth of the Neotoma Floridana.
16 Molar Tooth of the Mastodon of America.
17 Skull of the Hairy Sigmadon.
18 Incisory Tooth of the Isodan Pilorides, (viewed exteriorly).
19 Do., (viewed anteriorly).
20 Do., (viewed interiorly).
21 Cranium of the Mangusta Javanica.
22 Skull of the Semnopithecus Maurus, p. 508, i.
23 }
24 } Hands of the Orang-Outang, p. 491, i.
25 }
26 } Molar Teeth of the Viverra Gracilis.
27 }
28 Teeth of the Viverra, (front view).
29 Otolicnus Senegalensis.
30 White-faced Arctictes.
31 Hind-foot of the Ornithorynchus, p. 488, i.
32 Cranium of the American, p. 217, i.
33 Do. Malayan, p. 217, i.
34 Douc, p. 307, i.
35 Black Baboon, p. 499, i.
36 Sea Otter.
37 Smith's Fennec.
38 Skeleton of a Horse.

a.	The posterior maxillary, or jaw bone.
b.	The superior maxillary, or upper jaw.
c.	The orbit or cavity in which the eye is contained.
d.	The nasal bones, or bones of the nose.
e.	The suture, dividing the parietal bones below, from the occipital bones above.
f.	The inferior maxillary bone, containing the upper incisors or cutting teeth.
B.	The seven cervical vertebræ, or bones of the neck.
C.	The eighteen dorsal vertebræ, or bones of the back.
D.	The six lumbar vertebræ, or bones of the loins.
E.	The five sacral vertebræ, or bones of the paunch.
F.	The caudal vertebræ, or bones of the tail.
G.	The scapula, or shoulder blade.
H.	The sternum, fore-part of the chest or breast bone.
I.	The costæ, or ribs, seven or eight of which, articulating with the sternum, are called the *true ribs*, and the remaining ten or eleven, which are united by a cartilage, are called the *false ribs*.

(Plate XI.—Mammalia. Continued.)

K. The radius, or bone of the fore-arm.
MM. The ulna, or elbow, with its process, the olecranon.
L. The carpus, or knee, consisting of seven bones.
NN. The metacarpal, or shank bones; the large metacarpal, or cannon, or shank in front, and the smaller metacarpal, or splent bone behind. *g.* The fore-pastern and foot, consisting of the os suffraginis, or upper and longer pastern bone, with the sesamoid bones behind, articulating with the common and greater pastern; the os coronæ, or lesser pastern, the os pedis, or coffin bone, and the os navicular, or shuttle bone, not seen, and articulating with the smaller pastern and coffin bones; *h.* the corresponding bones of the hind feet.
OO. The small metacarpal, or splent bones.
P. The pelvis, or haunch, consisting of three portions; the ilium, the ischium, and the pubis.
QQ. The femur, or thigh bones.
RR. The patella, placed on the stifle joint.
SS. The tibia, and fibula (the latter is a small bone behind) are also called the ham bones.
TT. The bones of the tarsus, or hock, six in number.
UU. The metatarsals of the hind leg, called shank or common bones.
WW. The os calcis, or point of the hock.
XX. The sesamoid, or fetlock bones.

Fig.
39 Hyæna Dog.
40 Full-bottomed Monkey, p. 490, i.
41 Silky Tamarin.
42 Mammoth, p. 528, i.
43 Greater Anoplotherium.
44 Skull of Douglas's Geomys.
45 Hand of the Aye-Aye.
46 Cranium of a Carib, p. 217, i.
47 Fore-foot of the Ornithorynchus, p. 488, i.
48 Teeth of Carnivorous Animals.
a. Incisory; *b.* Canine; *c.* Molar.
49 Mouth of the Ornithorynchus, p. 488, i.

PLATE XII.—MAMMALIA.

Fig.
1 Chimpanzee, p. 491, i.
2 Orang-Outang, p. 491, i.
3 Ratel.
4 Entellus Monkey, p. 508, i.
5 Varied Monkey, p. 490, i.
6 White eyelid Monkey, p. 506, i.
7 Black Ape, p. 498, i.
8 Rib-nose Baboon, p. 499, i.
9 Siamang, p. 498, i.
10 Horned Sapajou, p. 508, i.
11 Douroucouli, p. 508, i.
12 Cacajao, p. 508, i.
13 Ruffled Lemur, p. 511, i.
14 Slender Loris.
15 Senegal Galago.
16 Colugo.
17 Braziliensis.

Fig.
18 Common Bat, p. 471, i.
19 Common Hedge-hog, p. 461, i.
20 Shrew Mouse, p. 453, i.
21 Pyrenees Desmary.
22 Indian Chrysochloris.
23 Common Mole, p. 457, i.
24 Canadian Scalops.
25 Tenrec, p. 464, i.
26 North American Bear, p. 545, i.
27 Racoon, p. 554, i.
28 Brown Coati, p. 308, i.
29 Potto.
30 American Badger, 551, i.
31 Wolverene, p. 424, i.
32 Canada Martin, p. 417, i.
33 American Skunk, p. 421, i.
34 Weasel, p. 611, i.

Fig.
35 Pondicherry Otter, p. 475, i.
36 Civet, p. 423, i.
37 Type Paradoxurus.
38 Cape Suricate.
39 Virginian Oppossum, p. 511, i.
40 Large Kangaroo, p. 560, i.
41 Koala.
42 Wombat.
43 Beaver, p. 477, i.
44 Common Hamster, p. 454, i.
45 Franklin's Marmot, p. 441, i.
46 Chickasee Squirrel, p. 436, i.
47 Capybara, p. 444, i.
48 Hippopotamus, p. 532, i.
49 Water Campagnol.
50 Crested Porcupine, p. 464, i.

PLATE XIII.—MAMMALIA.

Fig.
1 Coast Bathyergus.
2 Truncated Chlamyphorus.
3 Cape Pedetes.
4 Spalax, p. 461, i.
5 Labradore Sweeping Mouse.
6 Florida Neotoma.
7 Alpine Marmot, p. 441, i.
8 Fournier's Capromys.
9 Coypou.
10 Perchal Rat.
11 Chinchilla.
12 Rough-haired Echimys.
13 Common Dormouse, p. 453, i.
14 Pika.
15 Rabbit, p. 434, i.
16 Guinea Pig, p. 444, i.
17 Agouti, p. 444, i.
18 Radiated Condylura.
19 Gray Ichneumon, p. 419, i.
20 Raffles' Gymnura.
21 Cook's Phalanger.
22 Jerboa, p. 451, i.

Fig.
23, 24 } Kangaroo Rats.
25 Ondatra.
26 Drummond's Neotoma.
27 Lapland Lemming, p. 456, i.
28 Indian Manis.
29 Douglas's Camas Rat.
30 Duplicate of No. 26.
31 Cape Ant-Eater.
32 Ass, p. 258, i.
33 Musk Ox, p. 281, i.
34 Domestic Hog, p. 344, i.
35 Ethiopian Boar, p. 343, i.
36 Coaita, p. 508, i.
37 Capparo, p. 508, i.
38 Araguato, p. 508, i.
39 Siamiri, p. 508, i.
40 Field Mouse, p. 452, i.
41 Aye-aye.
42 Short-tailed Indris.
43 Slow Lemur, 511, i.
44 Proboscis Monkey, p. 490, i.

Fig.
45 Banca Tarsius.
46 Pteropus Javanicus.
47 Larvatus.
48 Teledu.
49 Tana Tupaia.
50 Brown Paca, p. 444, i.
51 Lama, p. 540, i.
52 Striated Monkey, p. 508, i.
53 Spotted Hyæna, p. 409, i.
54 Long-nosed Perameles.
55 Yapock.
56 Spotted Dasyurus.
57 English Pointer, p. 391, i.
58 Clouded Tiger, p. 374, i.
59 Fulvous Fox, p. 406, i.
60 Spiny Echidna.
61 Duck-billed Platypus, p. 488 i.
62 Bactrian Camel, p. 535, i.
63 Common Seal, p. 481, i.
64 Walrus, p. 487, i.
65 Sea Bear, p. 486, i.

PLATE XIV.—MAMMALIA.

Fig.
1 Indian Elephant, p. 516, i.
2 African Elephant, p. 516, i.
3 Collared Peccary, p. 348, i.
4 Cape Hyrax.
5 Indian Rhinoceros, p. 529, i.
6 Great Ant-Eater.
7 Nine-Banded Armadillo, p. 469, i.
8 Three-toed Sloth, p. 557, i.
9 Giraffe, p. 534, i.

Fig.
10 Lesser American Flying Squirrel, p. 436, i.
11 Nepaul Stag, p. 319, i.
12 Thibet Musk, p. 318, i.
13 Fasciculated Porcupine, p. 464, i.
14 Domestic Goat, p. 299, i.
15 Chamois, p. 304, i.
16 American Tapir, p. 552, i.
17 American Bison, p. 276, i

Fig.
18 African Sheep, p. 293, i.
19 Dugong.
20 Narwal, p. 260, ii.
21 Senegal Manatus.
22 Porpoise, p. 264, ii.
23 Common Whale, p. 251, ii.
24 Great-headed Cachalot, p. 262. ii.
25 Flying Squirrel, p. 440, i.

ORNITHOLOGY.—Plates XV. XVI. XVII. XVIII. XIX. XX.

Introduction, p. xxi to xxiii.

PLATE XV.—ORNITHOLOGY.

Fig.
1 Griffon Vulture, p. 42, ii.
2 White-headed Eagle, p. 33, ii.
3 Jerfalcon, p. 45, ii.
4 Dalhousie's Owl, p. 55, ii.
5 Coal Titmouse, p. 151, ii.
6 Abyssinian Hornbill.
7 Raven, p. 87, ii.
8 Canada Jay, p. 98, ii.
9 Wryneck, p. 103, ii.
10 Sacred Mino.
11 Noisy Roller, p. 99, ii.
12 Red-legged Crow, p. 87, ii.
13 Wattle Bird.
14 American Kinglet.

Fig.
15 Chinese Oriole, p. 143, ii.
16 Red-tailed Bird of Paradise, p. 110, ii.
17 Slender Nuthatch, p. 107, ii.
18 Black and White Creeper, p. 108, ii.
19 Reddish Oxpecker.
20 Black-throated Green Warbler, p. 153, ii.
21 Quizel.
22 Speckled Nutcracker.
23 Purple Grakle.
24 Crowned Pigeon, p. 120, ii.
25 Say's Muscicapa.

Fig.
26 Chinese Pastor.
27 Crested Hoatzin.
28 Supercilious Dipper.
29 Aromatic Pigeon, p. 120, ii.
30 Cedar Bird.
31 Hoopoe, p. 108, ii.
32 Bullock's Bee-Eater.
33 Scaly-backed Humming Bird, p. 167, ii.
34 Gigantic Dacelo.
35 Arctic Wagtail, p. 153, ii.
36 Olive Bush-Shrike, p. 50, ii.
37 Emu, p. 23, ii.
38 Ostrich, p. 19, ii.

PLATE XVI.—ORNITHOLOGY.

Fig.
1 King of the Vultures, p. 42 and 44, ii.
2 Wedge-tailed Eagle, p. 38, ii.
3 Secretary, p. 42 and 50, ii.
4 Gorget Bird of Paradise, p. 110, ii.
5 Red-tailed Neops.
6 Brazilian Caracara Eagle, p. 36, ii.
7 Harpy Eagle, p. 38, ii.
8 Blue Berry-Eater.
9 Bearded Vulture, p. 42, ii.
10 American Hen Harrier, p. 50, ii.
11 Mottled Owl, p. 55, ii.
12 Swallow-tailed Hawk, p. 46, ii.
13 Goshawk, p. 46, ii.
14 Collared Platyrhynchos.
15 Purple-throated Querula.
16 Azure Creeper, p. 108, ii.

Fig.
17 Black Ceblepyris.
18 Reddish Opetiorhynchus.
19 Long-bellied Cuckoo, p. 113, ii.
20 Bearded Tricophorus.
21 Elegant Linnet, p. 158, ii.
22 White-crowned Enicurus.
23 Great Honey Guide, 113, ii.
24 Blue-necked Barbet.
25 No fig.
26 Variegated Musophaga.
27 Spotted-bellied Barbet.
28 Cupreous Cuckoo, p. 113, ii.
29 Blue Cuckoo, p. 113, ii.
30 Senegal Coucal, p. 113, ii.
31 Malcoho, p. 113, ii.
32 African Cuckoo, p. 113, ii.

Fig.
33 New Holland Scythrops.
34 Red-throated Pogonias.
35 Racket-tailed Parrot, p. 113, ii.
36 Magellanic Woodpecker, p. 104, ii.
37 Black-breasted Soui-Manga.
38 Scarlet Drepanis.
39 Olive-coloured Saltator.
40 Hook-billed Dendrocolaptes.
41 Bright-billed Oxyrhynchus.
42 White-browed Anabates.
43 Wall Creeper, p. 108, ii.
44 Crescent Naped Honey Eater.
45 Climbing Climacteris.
46 Reddish Pepit, p. 153, ii.
47 Brisbane's Epimachus.
48 Macleay's King-fisher, p. 236, ii.

PLATE XVII.—ORNITHOLOGY.

Fig.
1 Sardinian Starling, p. 144, ii.
2 Red-winged Troopial.
3 New Holland Menura, p. 110, ii.
4 Orchard Baltimore.
5 Green Roller, p. 99, ii.
6 Red-headed Saw-bill.
7 Crested Vanga.
8 Blue-tailed Pitta.
9 Skylark, p. 150, ii.
10 Brown Antcatcher.
11 Great American Shrike, p. 50, ii.
12 African Colaris, or Roller, p. 99, ii.
13 Elegant Rupicola.
14 Fork-tailed Manakin.
15 Aracari Toucan, p. 100, ii.
16 Green Tody.
17 Gold and Green Jacmar.

Fig.
18 Spotted-billed Aragon.
19 American Keel-bill.
20 Ruffled Ptilonorynchus.
21 New Holland Ptiloris.
22 Hook-billed Chloropsis.
23 Viellot's Psaris.
24 Crested Sparactes.
25 Crested Edolius.
26 Bare-necked Coracina.
27 Senegal Coly.
28 Variegated Chatterer, p. 98, ii.
29 Yellow-billed Phibalura.
30 Many-coloured Tanagu.
31 Masked Weaver.
32 Supercilious Whidaw Bunting, p. 151, ii.
33 Evening Grosbeak.

Fig.
34 Grosbeak.
35 Abyssinian Hyreus.
36 Brown's Malurus.
37 Bloxam's Plant-Cutter.
38 White-winged Cross-bill.
39 Xenops.
40 Spotted Orthonyx.
41 Lapland Long-spurred Bunting, p. 151, ii.
42 Marsh Wren, p. 153, ii.
43 Cat Thrush, p. 137, ii.
44 Coast Muscipeta.
45 Blue Gnatcatcher.
46 Stone Chat, p. 153, ii.
47 Alpine Accentor.
48 Striated Manakin.
49 Blue Chatterer, p. 99, ii.

PLATE XVIII.—ORNITHOLOGY.

Fig.
1 Galeated Curassow, p. 72, ii.
2 White-necked Swallow, p. 160, ii.
3 Macartney's Cock, p. 66, ii.
4 White-bellied Swift, p. 160, ii.
5 Japan Peacock, p. 66, ii.
6 Impeyan Lophophorus.
7 Cold-River Night Jar.
8 Argus Pheasant, p. 74, ii.
9 Berbice Goatsucker, p. 162, ii.
10 Diard's Pheasant, p. 74, ii.
11 Crested Pintado, p. 76, ii.
12 Crested Curassow, p. 71, ii.

Fig.
13 Crested Polyplectron.
14 Marail.
15 Honduras Turkey, p. 66, ii.
16 Welcome Quail, p. 85, ii.
17 Willow Ptarmigan, p. 77, ii
18 Spotted Grouse, p. 80, ii.
19 Banded Sandgrouse, p. 80, ii.
20 Painted Partridge, p. 83, ii.
21 Coromandel Courier.
22 Fork-tailed Cock, p. 61, ii.
23 Galeated Casuary, p. 25, ii.
24 Nepaul Tragopan, p. 74, ii.

Fig.
25 American Ostrich, p. 23, ii.
26 Crowned Cryptonyx.
27 Pallas' Sandgrouse, p. 80, ii.
28 Faithful Jacana.
29 Andalusian Turnix.
30 Golden-breasted Trumpeter.
31 Barred Tinamoo.
32 Guasa.
33 White-throated Glareola.
34 Little Bustard, p. 77, ii.
35 Horned Screamer.

PLATE XIX.—ORNITHOLOGY.

Fig.
1 White-crowned Lapwing, p. 194, ii.
2 Black-necked Longshank.
3 Sanderling, p. 192, ii.
4 Black Oyster-catcher.
5 Thick-Knee.
6 Purple Heron, p. 182, ii.
7 White Stork, p. 175, ii.
8 Red Flamingo, p. 187, ii.
9 Pigmy Curlew, p. 190, ii.
10 American Aroset, p. 189, ii.
11 Roseate Spoonbill, p. 186, ii.
12 Wood Ibis, p. 178, ii.
13 Wimbril, p. 194, ii.
14 Dunlin, p. 194, ii.

Fig.
15 SemipalmatedSandpiper,p.193,ii.
16 Variegated Helias.
17 Martinico Gallinule.
18 Variegated Snipe, p. 191, ii.
19 Wilson's Snipe, p. 191, ii
20 American Coot, p. 197, ii.
21 Scarlet Ibis, p. 178, ii.
22 No fig.
23 Little Guillemot, p. 219, ii.
24 Crested Grebe, p. 198, ii.
25 Bewick's Swan, p. 224, ii.
26 Canada Goose, p. 229, ii.
27 Foolish Guillemot, p. 219, ii.
28 Duplicate of No. 23.
29 Ruffle-headed Garrot.

Fig.
30 Red-breasted Merganser.
31 White-bellied Darta.
32 Lesser Tern, p. 212, ii.
33 Yellow-billed Skimmer.
34 Golden Eye Garrot, p. 233, ii.
35 Mallard.
36 White Pelican, p. 201, ii.
37 Golden-breasted Trumpeter.
38 Bronzed Jacana.
39 Wilson's Storm Petrel, p. 210, ii.
40 Burgomaster Gull, p. 210, ii.
41 Great Northern Diver, p. 219, ii.
42 Brown Gannet, p. 208, ii.
43 Richardson's Skua, p. 216, ii.
44 White Sheathbill.

PLATE XX.—ORNITHOLOGY.

Fig.
1 Numidian Crane, p. 172 & 180, ii.
2 Senegal Jabiru, p. 180, ii.
3 Egret.
4 Scolopaceous Heron, p. 180, ii.
5 Turnstone.
6 Collared Crane, p. 172, ii.
7 Kildeer Plover, p. 192, ii.
8 Least Bittern, p. 104, ii.
9 Puffin, p. 220, ii.
10 White-crowned Night Heron, p. 180, ii.
11 Crested Boat-bill.
12 Gigantic Adjutant, p. 172, ii.
13 Scaup Duck, p. 233, ii.
14 Coromandel Anastomus.
15 Martinico Porphyrio.
16 New Holland Cereopsis.
17 Marbled Godwit, p. 192, ii.
18 Horned Grebe, p. 221, ii.
19 Virginian Water Rail, p. 197, ii.
20 Tufted Umbre.
21 Surf Duck, p. 232, ii.

Fig.
22 Wandering Albatross, p. 204, ii.
23 Senegal Podoa.
24 Diving Petrel-Puffin, p. 220, ii.
25 Shag.
26 Frigate Bird.
27 Common Tropic Bird.
28 Dodo, p. 27, ii.
29 King Eider, p. 234, ii.
30 Gadwell.
31 Tufted Stariki.
32 Great Auk, p. 219, ii.
33 Crested Penguin, p. 217, ii.
34 Patagonian Penguin, p. 216, ii.
35 Long-tailed Hareld.
36 American Wigeon, p. 234, ii.
37 Australian Apteryx.
38 Summer Duck, p. 233, ii.
39 Skeleton of a Bird, Intro. p. xxi.
40 Bones of the Wing and their Feathers.
41 External Anatomy of Birds, Intro. p. xxi.

Fig.
42 Anisodactyli.
43 Lygodactyli.
44 Alcyones, p. 236, ii.
45 Cursores, and fig. 49.
46 Chelidones.
47 Palmipedes.
48 Birds with retracted legs.
49 Cursores.
50 Robust Bill, serrated.
51 Straight narrow Bill.
52 Straight Bill, notched.
53 Straight Bill, point inflected.
54 Robust notched Bill.
55 Straight cuneate Bill.
56 Cylindrical Bill.
57 Recurved Bill.
58 Slender, curved, depressed Bill.
59 Gibbous arcuated Bill.
60 Spatulate Bill.
61 Groping Bill.
62 Pinnatipedes.
63 Elongated, compressed Bill.

ICHTHYOLOGY.—Plates XXI. XXII.

ORDER I. ACANTHOPTERYGIANS.

This order comprehends by far the most numerous race of fishes. They are distinguished by the spines which supply the place of the first rays of their dorsal fins, or which alone support the first fin of the back, where there are two; in some species, instead of a first dorsal fin, it is represented by a few unconnected spines. The first rays of their anal fins consist of simple spines, and each ventral fin has usually one.

Family I. Percoides.—(Perch.)

Body oblong, covered with rough and hard scales; operculum or preoperculum, and frequently both, have dentated or spinous margins; jaws, fore-part of vomer, and palatine bones, provided with teeth.

Division I. Percoides Thoracici.

Ventral fins inserted under the pectorals. They are all edible, wholesome, and agreeable to the taste.

Sub-division 1.—Branchiæ with seven rays; back with two fins, teeth small and dense, as the pile on velvet.

Perca granulata, pl. 21, f. 14.
Pomatomus telescopium, pl. 22, f. 22.

Sub-division 2.—Having two dorsal fins; long pointed teeth intermixed with the small densely set teeth, like the pile on velvet.

Diplorion maculata, pl. 22, f. 35.

Division II.

With seven branchial rays and one dorsal fin.

Sub-division 1.—With seven branchial rays and one dorsal fin; teeth dense as the pile on velvet.

Division III.

With less than seven branchial rays.

Sub-division 1.—One dorsal fin; some species with hooked teeth interspersed among the dense ones.

Sub-division 2.—Without interspersed hooked teeth.

Sub-division 3.—Six branchial rays; and two dorsal fins.

Division IV.

With more than seven branchial rays.

Sub-family I. Percoides Jugulares.

With the throat further forward than the pectoral fins.

Division V. Abdominal Perches.

Ventral fins placed further back than the pectorals.

Sub-division 1.—Ventral fins entirely behind; pelvis separated from the shoulder bones.

Family II. Mailed Cheeks.

Head variously mailed, and protected by several bony processes. Suborbital bones more or less extended over the cheeks, articulating behind with the preoperculum.

Trigla pini, pl. 21, f. 3.
Cephalacanthes spinarella, pl. 22, f. 15.
Scorpæna Scropha, pl. 22, f. 30.

Tænianotes tricanthus, pl. 22. f. 23.
Apistus marmoratus, pl. 22, f. 19.
Oreosoma coniferum, pl. 22, f. 12.

Intermediate betwixt this and the next family, Cuvier places a small oval fish, whose whole body is thickly beset with hill-like protuberances, four on the back and ten on the abdomen, arranged in double series, with smaller intermediate ones. Inhabits the Atlantic.

Family III. Scienoides.

Preoperculum dentated; operculum spinous; vomer and palatines destitute of teeth; cranial and facial bones generally cavernous; muzzle more or less gibbous; ventral fins frequently scaly. Some are provided with two, and others with only one dorsal fin.

Eques Balteatus, pl. 22, f. 24.
Heliasus frenatus, pl. 22, f. 31.

Sub-division 1.—Two dorsal fins.

Sphyræna maculata, pl. 22. f. 7.
Sciæna aquila, pl. 21. f. 1.

Sub-division 2.—One dorsal fin; with seven branchial rays; preoperculum dentated.

Sub-division 3.—With less than seven branchial rays, and an interrupted lateral line.

Family IV. Sparoides.

Palate destitute of teeth; covered with scales, but none on the fins; muzzle not gibbous, nor bones of head cavernous, destitute of spines of the operculum, and indentations on the preoperculum; pylorus provided with cæcal appendages; have never more than six branchial rays. Divided according to the form of their teeth.

Sub-division 1.—Sides of the jaws provided with round molars in the form of pavement.

Pagelus centrodontus, pl. 21, f. 9.

Sub-division 2.—Conical teeth on the sides of the jaws, usually in a single range; some of the anterior are drawn into large hooks.

Sub-division 3.—Teeth dense and short, as the pile on velvet; bent and crowded together like cards around the jaws in some; external row strongest.

Sub-division 4.—Teeth trenchant.

Family V. Menides.

Differing from the former families, in the upper jaw being extremely extensible and retractile, owing to the length of the intermaxillary pedicles, which withdraw between the orbits; body scaly.

Samaris Vulgaris. Destitute of teeth in the vomer.

Family VI. Squamipennes.

The soft, and in some instances, the spinous parts of their dorsal and anal fins covered with a scaly incrustation. Body usually greatly compressed; teeth long, thin, bristle-shaped, and collected in several close rows like the hairs of a brush.

Ephippus Orbis, pl. 22, f. 25.
Holacanthus ciliaris, pl. 21, f. 20.

Family VII. Scomberoides.

Scales small, body smooth, cæca numerous, and often united in clusters; with a very powerful tail and caudal fin; first dorsal fin entire; last rays of the second, and those of the anal, detached, forming spurious fins spotted.

Scomber maculosus, pl. 21, f. 6.
Xiphias gladius, pl. 21, f. 11.
Cybium lineolatum, pl. 22, f. 36.
Zeus faber, pl. 22, f. 34.

Family VIII. Tænioides.

Body elongated, flattened on the sides; scales very small.

Sub-division 1.—Muzzle elongated; mouth cleft, and armed with strong, pointed, cutting teeth; lower jaw advancing beyond the upper one.

Lepidopus argyreus.

Sub-division 2.—Mouth small but slightly cleft.

Family IX. Theutyes.

Provided with the same armature as the Scomberoides, such as exists on the sides of the tail in some genera, or the horizontal line which is to be found in others. The body in all the genera, is compressed and oblong; mouth small, slightly, if at all, projectile; each jaw provided with a row of cutting teeth; tongue and palate destitute of teeth; a single dorsal fin.

Acanthurus Delisianus, pl. 21, f. 19.
Naseus unicornis, pl. 22, f. 32.

Family X. Labyrinthiform Pharyngeals.

Part of the superior pharyngeals divided into small irregular laminæ, which intercept minute cells, in which water is retained for the purpose of moistening their gills when they quit the water, which they frequently do.

Anabas testudineus, pl. 21, f. 28.
Polycanthus colisa, pl. 22, f. 33.
Lepidopus argyrus, pl. 21, f. 13.

Family XI. Mugiloides.

Body nearly cylindrical, covered with large scales, and provided with two separate dorsal fins, the first of which have only four spinous rays; ventral fins inserted a little behind the pectorals.

Mugil Cephale, pl. 21, f. 25.

Family XII. Gobioides.

Dorsal spines thin and flexible.

Blennius Palmicornis, pl. 21, f. 18.
Gobius lanceolatus, pl. 22, f. 37.
Gobioides broussonectii, pl. 22, f. 27.
Callionymus fasciatus, pl. 22, f. 26.

Family XIII. Pediculatea Pectorales.

Pectorals supported by the elongation of the carpal bones. Skin naked; pectorals supported by two arms, each of which is provided with two bones, which correspond to the radius and ulna in the mammalia, but which, in reality, belong to the carpus. Ventrals placed very far before the pectoral fins, opercular and branchiostegous rays enveloped in the skin; only opening in the gills, situated behind the pectorals.

Lophius piscatus, pl. 22, f. 14.
Chironectes nesogallicus, pl. 22, f. 21.

Family XIV. Labroides.

Body oblong and scaly; a single dorsal fin supported in front by spines, each having a membranous appendage; jaws covered by fleshy lips; three pharyngeals, two upper ones attached to the cranium, lower one large, all of them provided with tesselated or laminiform teeth.

Labrus vittatus, pl. 21, f. 23.
Epibulus insidiator, pl. 22, f. 28.
Xirichthys Cyanirostris, pl. 22, f. 29.

Family XV. Flute Mouths.

Æthmoidal and adjacent bones produced in the shape of a tubular mouth in front of the cranium; the mouth formed by the intermaxillary, maxillary, and mandibular bones.

Fistularia Chinensis, pl. 21, f. 15.
Centriscus scolopax, pl. 22, f. 6.

ORDER II. ABDOMINAL MALACOPTERYGIANS.

The ventral fins are suspended to the under part of the abdomen, and situated behind the pectorals, but not attached to the shoulder bones.

Family I. Cyprinidæ.

Mouth but slightly cleft; jaws weak, generally without teeth, and bordered by the intermaxillaries by strongly toothed pharyngeals; branchial rays small; body scaly; destitute of an adipose dorsal fin.

Cyprinus auratus, pl. 22, f. 11.
Cyprinus carpio, pl. 21, f. 17.

Family II. Esoces.

Destitute of an adipose fin; edge of the upper jaw

usually formed by the intermaxillary, and when not so, the maxillary is devoid of teeth, and concealed in the thickness of the lips; with the exception of the Microstomæ the dorsal and anal fins are opposite each other.
Exocetus volitans, pl. 22, f. 8.

FAMILY III. SILURIDÆ.

Completely destitute of true scales, skin quite naked, or with large osseous plates; intermaxillaries suspended under the æthmoid, forming the edge of the upper jaw: maxillaries simple vestiges, or extended into cirri. Intestinal canal simple, destitute of cæca, bladder large; first ray of dorsal and pectoral fins, with strong spines; and like the salmon, frequently with an adipose fin behind.

FAMILY IV. SALMONIDES.

Body scaly; first dorsal fin having two soft rays, followed by a second adipose, formed of a cuticle filled with fatty matter, and destitute of rays: they have numerous cæca and a natatory bladder. Structure of jaws subject to much variety.
Salmo salar, pl. 22, f. 1.

FAMILY V. CLUPEÆ.

Destitute of an adipose fin; jaws formed by intermaxillaries, having no pedicles in the middle, and by maxillaries on the sides; body scaly; most species have a natatory bladder, and many cæca. Some of the species ascend rivers.
Clupea pilchardus, pl. 22, f. 4.
Engraulis encrasicohlus, pl. 21, f. 2.

ORDER III. SUB-BRACHIAN MALACOPTERYGIANS.

Ventrals placed under the pectorals; pelvis directly suspended to the shoulder bones.

FAMILY I. GADITES.

Ventrals pointed and attached to the throat; body slightly elongated, compressed; scaly; head scaleless; fins soft; jaws and front of vomer with pointed teeth, set in several rows, resembling a rasp; branchiæ large, seven-rayed: most of the species have three fins on the back; one or two situated behind the anal opening and a distinct caudal fin.

FAMILY II. FLAT FISHES.

Head devoid of symmetry; both eyes on one side, which is always uppermost: two sides of the mouth unequal; body much compressed; dorsal fin generally extending along the whole back, and the anal occupies the under part, appearing as if a continuation of the ventral, which are often united with it. Some of the species have their head reversed from the ordinary law.
Platessa Carnaria, pl. 21, f. 12.
Solea Zebra, pl. 21, f. 24.
Lampris guttatus, pl. 22, f. 9.

FAMILY III. DISCOBOLI.

Ventral fins forming a disk.
Cyclopterus lampus, pl. 22, f. 18.
Echeneis Remora, pl. 21, f. 16.

ORDER IV. APODAL MALACOPTERYGIANS.

There is but one natural family in this order. The species are of an elongated form; skin thick and soft; scales in consequence nearly invisible; bones few.

FAMILY I.

Anguilla conger.
Ophidium tetradens.

ORDER V. LOPHOBRANCHIATE FISHES.

Jaws perfect and free; gills in place of being like the teeth of a comb, are divided into small tufts; arranged in pairs along the branchial arches. They are enclosed beneath a large operculum, fixed down on both sides by a membrane, which exhibits only a small orifice for the exit of the water, and showing in its thickness vestiges of rays only; scutellated plates of mail cover their body, which is usually of an angular shape.
Syngnathus acus, pl. 22, f. 3.
Hippocampus foliatus, pl. 22, f. 10.
Pegasus Draco, pl. 22, f. 16.

ORDER VI. PLECTOGNATHES.

Maxillary bone permanently attached to the side of intermaxillary, by which the jaw is alone constituted, and in the manner in which the palatine anal is united by its suture to the cranium, and consequently destitute of power of motion. Opercula and rays concealed under a thick skin, through which only a small branchial fissure is visible. They have no true ventral fins.

FAMILY I. GYMNODONTES.

In place of teeth a small ivory substance, internally divided into laminæ, which, in their aggregate, resemble a parrot's bill. Opercula small, five rays on each side, all nearly concealed.
Diadon Histrix, pl. 22, f. 17.
Tetraodon hispidus, pl. 21, f. 4.
Cephalus brevis, pl. 21, f. 5.

FAMILY II. SCLERODERMES.

Mouth conical or pyramidical, projecting from the region of the eyes, and terminating in a small mouth, provided with a few distinct teeth in each jaw. Skin generally rough or provided with hard scales.
Balistes aculeatus, pl. 21, f. 22.
Ostracion auritus, pl. 21, f. 21, and Ostracion turritus, pl. 22, f. 13.
Platax gaimardi, pl. 22, f. 20.

CHONDROPTERYGIANS.

Several of this division approach in their formations to the reptiles, in the conformation of their auditory and genital organs. In some, the organization is so simple, and the skeleton so greatly reduced, that they hardly deserve a place among vertebral animals. They therefore constitute a series somewhat similar to the first, in the same manner as Marsupial animals bear a similitude to the hoofed Mammalia.

The skeleton is essentially cartilaginous, containing no osseous fibres, the calcarious matter being deposited in small grains, and not in filaments; conseqnently they are destitute of sutures in their cranium, which is always formed of a single piece.

ORDER I. STURIONES.

Gills with a single wide opening, and provided with an operculum, but destitute of rays in the membrane.
Acipenser huso, pl. 21, f. 27.
Callorhynchus Australis, pl. 21, f. 26.

ORDER II. FIXED GILLED CHONDROPTERYGIANS.

Organs for the escape of water pierced in the skin, sometimes terminating in a common duct, through which the water is transmitted; little cartilaginous arches are frequently suspended in the muscles opposite to the external edges of the branchiæ, and which may be denominated branchial ribs.

Family I. Selacpii Plagiostomi.

Palatines and post-mandibularies, only provided with teeth, and supply the place of jaws, which are represented by mere vestiges of bone; their apparent jaw suspended by a single bone to the cranium, which represents the tympanal, jugal, and temporal bones, and also the preoperculum: hyod bone affixed to this pedicle, and supports the branchiostegal rays, as in ordinary fishes, although hardly visible externally; followed by the branchial arches, but neither compose the operculum. Provided with both pectoral and ventral fins, the latter on the abdomen, placed on each side of the anal opening.

Squalus Zygæna, pl. 21, f. 8.
Pristis antiquorum, pl. 21. f. 7.
Torpedo galvanii, pl. 21, f. 10.

Family II. Suctorii Cyclostomi.

The suckers are the most imperfect of all vertebral animals, as regards the skeleton: they are destitute of both pectoral and ventral fins; body elongated, terminated before by a fleshy lip and cartilaginous ring. Annular portion of the vertebræ, not cartilaginous throughout its whole circle: destitute of ordinary ribs; branchial ones much developed, and united to each other, but devoid of solid branchial arches: the branchiæ resembling purses, resulting from the junction of one part of a branchia with the opening of that contiguous: ear enclosed by the cranium; nostrils with a single orifice.

Petromyzon marinus, pl. 22, f. 5.
Gastrobranchus cæcus, pl. 22, f. 2.

PLATE XXI.—ICHTHYOLOGY.

Fig.
1 The Maigre.
2 Anchovy.
3 Red Gurnard, p. 298, ii.
4 Moon Fish, p. 291, ii.
5 Short Sun Fish, p. 287, ii.
6 Spanish Mackerel.
7 Cirrated Saw Fish.
8 Dog Fish, p. 270, ii.
9 Sea Bream, p. 297, ii.
10 Torpedo, p. 278, ii.

Fig.
11 Sword Fish, p. 294, ii.
12 Flounder, p. 301, ii.
13 Scabbard Fish.
14 Granulated Perch, p. 298, ii.
15 Chinese Pipe Fish, p. 290, ii.
16 Sucking Fish, p. 292, ii.
17 The Common Carp, p. 305, ii.
18 Crested Blenny, p. 295, ii.
19 Yellow-bellied Acanthurus.

Fig.
20 Holacanthus Ciliaris.
21 Ostracion Auritus, p. 291, ii.
22 Common File Fish, p. 290, ii.
23 Labrus or Wrasse, p. 296, ii.
24 Variegated Sole, p. 300, ii.
25 The Grey Mullet.
26 Callorhynchus Australis.
27 The Beluga, p. 260, ii.
28 The Tree Climber.

PLATE XXII.—ICHTHYOLOGY.

Fig.
1 The Salmon, p. 301, ii.
2 Glutinous Hag, p. 282, ii.
3 Great Pipe Fish, p. 290, ii.
4 Pilchard, p. 312, ii.
5 Lamprey, p. 281, ii.
6 Snipe Fish.
7 Sphyræna maculata.
8 Flying Fish, p. 303, ii.
9 King Fish.
10 Sea Horse, or Unicorn, p. 290, ii.
11 The Gold Carp, p. 306, ii.
12 The Mountain Fish.
13 Ostracion turritus, p. 291, ii.

Fig.
14 The Fishing Frog, p. 288, ii.
15 Cephalacanthes spinarella.
16 The Flying Dragon.
17 Porcupine Diodon, p. 291, ii.
18 The Lump Sucker.
19 The Sea Locust.
20 Platax gaimardi.
21 Chironectes nesogallicus.
22 Large eyed Pomatome.
23 Ribbon Fish.
24 Eques Balteatus.
25 The Globe Fish.

Fig.
26 Dragonet.
27 Broussonet's Goby.
28 Epibulus insidiator.
29 Razor Fish.
30 Red Sea Scorpion.
31 Heliasus frenatus.
32 The Monoceros.
33 Polycanthus colisa.
34 Dory, p. 298, ii.
35 Diplorion maculata.
36 Dybium lineolatum.
37 The Lancet Gobius.

PLATE XXIII.—CRUSTACEA.

P. 576–578, Vol. ii.

Fig.
1 Thelphusa fluviatilis.
2 Portunus corrugatus.
3 Leucosia Urania.
4 Calappa tuberculata.
5 Pisa tetraodon.
6 Dorippe nodulosa.
7 Remipes testudinarius.
8 Pagurus laticauda.
9 Palinurus locusta.
10 Porcellana platycheles.
11 Astacus Marinus.
12 Palæmon Serratus.
13 Nebalia Herbstii.

Fig.
14 Allima hyalina.
15 Cyamus ceti.
16 Leucothoe articulosa.
17 Apseude talpas.
18 Æga Marginata.
19 Anthura gracilis.
20 Stenosoma lineare.
21 Armadillo vulgaris.
22 Cyclops quadricornis.
23 Cypris ornata.
24 Branchipus stagnalis.
25 Anthosoma Smithii.

Anatomy of a Plagusia.

Fig.
26 Internal structure of Thorax.
27 Post Abdomen.
28 Antennæ.
29 Teeth.
30 Antennæ.
31 Head.
32 Eyes.
33 Internal structure of Abdomen.
34 Teeth.
35 Tail.

PLATE XXIV.—MOLLUSCA.

P. 579–584, Vol. ii.

Fig.
1 Argonauta Argo.
2 Spirula Peronii.
3 Conus generalis.
4 Lymnæa stagnalis.
5 Limax agrestis.

Fig.
6 Testacella Scutulum.
7 Vitrina beryllina.
8 Cypræa Europea.
9 Ancylus fluviatilis.
10 Cyclostoma elegans.

Fig.
11 Paludina impura.
12 Haliotis tuberculata.
13 Turbo littoreus.
14 Pleurobranchus plumula.
15 Helix aspersa.

(Plate XXIV. Mollusca. Continued.)

Fig.
16 Teredo navalis.
17 Laphysia deplians.
18 Neritina fluviatilis.
19 } Buccinum undatum.
20 }
21 Patella vulgata.
22 Alimentary Canal of fig. 14.
23 }
24 }
25 } Anatomy of fig. 21.
26 }
27 }
28 }
29 Jaws of Tritonia.
30 Tethys leporina.
31 }
32 } Anatomy of Buccinum undulatum.
33 } See figs. 19, 20.
34 }
35 Natica monilifera.
36 }
37 } Hyalæa tridentata.
38 }
39 Venus Verrucosa.
40 Mactra Neapolitana.
41 Anomia ephippium.
42 Sigaretus Halistoideus.
43 Anadonta cygnea.
44 Pleurobranchus. See fig. 14.

Fig.
45 Mya arenaria.
46 } Donax trunculus.
47 }
48 Cytherea Chione.
49 Unio pictorum.
50 Cyclas cornea.
51 Piscidium obliquum.
52 Spondylus gæderopus.
53 Artemis orbiculata.
54 Chama gryphoides.
55 Chama antiquata.
56 Pectunculus Pilosus.
57 Pupa sexdentatus.
58 Succinea amphibia.
59 Arca Noæ.
60 Cardium rusticum.
61 Valvata piscinalis.
62 No fig.
63 Nautilus Pompilius.
64 Tridacna gigas.
65 Toothed cartilage of Helix Pomatia.
66 Nervous system of Aplysia.
67 & 67* Clio Borealis.
68 Cutting tooth of Bulla aperta. See fig. 83.
69 Venerupis irus.
70 Arca barbata.
71 Mytilus edulis.

Fig.
72 Lima squamosa.
73 Ostrea edulis.
74 See fig. 56.
75 Crania personata.
76 See fig. 71.
77 Pecten Jacobæus.
78 Chiton cinereus.
79 } Purpura lapillus.
80 }
81 Amphitrite magnifica.
82 Serpula vermicularis.
83 }
84 } Bulla aperta.
85 }
86 }
87 } Bulla hydatis.
88 }
89 Muscle of Pholas. See fig. 95.
90 Avicula Tarentina.
91 Pinna nobilis.
92 Apparatus of Vision in Helix Pomatia.
93 See fig. 78.
94 Balanus communis.
95 Pholis dactylus.
96 Solen Vagina.
97 Tellina planata.
98 Isocordia cor.

PLATE XXV.—REPTILES.

P. 433–5, Vol. ii.

Fig.
1 Radiated Tortoise. }
2 Painted Tortoise. } p. 338, ii.
3 Close Tortoise. }
4 The Hawk-billed Turtle, p. 342, ii.
5 Common Crocodile, p. 392, ii.
6 Gangetic Crocodile, p. 393, ii.
7 Common Alligator, p. 392, ii.
8 Muricated Agama.
9 Mitred Basilisk, p. 403, ii.

Fig.
10 Dracæna Guianensis.
11 Striped Amevia.
12 Egg of Crocodile, p. 392, ii.
13 Common Guana.
14 Scallop-tailed Gecko, p. 400, ii.
15 Teguixin Lizard, p. 402, ii.
16 Flying Dragon, p. 406, ii.
17 Common Chameleon, p. 403, ii.
18 Great Water Newt.

Fig.
19 Siren.
20 Proteus.
21 Bull Frog, p. 381, ii.
22 Brown Toad, p. 384, ii.
23 Common Rattlesnake, p. 421, ii.
24 South American Boa, p. 429, ii.
25 Shining Amphisbæna, p. 428, ii.
26 Galley Wasp, p. 467, ii.
27 Apoidal Apus.

ENTOMOLOGY.—Plates XXVI. XXVIII. XXIX.

ARACHNIDES.

The Arachnides are oviparous animals, provided with articulated members, but do not undergo a metamorphosis, similar to insects. They respire, either by bronchiæ or by means of a trachea, the openings for the admission of air being stigmatiform; and they are destitute of antennæ.

ORDER I. PULMONARIÆ.

With a heart; each side of the abdomen with bronchial sacs; six to eight eyes; two pedipalpi; two jaws and palpi; and four pair of feet; sexual organs double.

Section I.—Pedipalpi.

Very large palpi; abdomen distinctly annulated, having no web-spinning papillæ.

Family I. Scorpionides.

With a sessile abdomen, provided with four spiracles, the six terminal segments forming a tail; the last one pointed, and serving as a sting, perforated for the passage of poison; palpi forceps-shaped.
Scorpio Afer, pl. 26, f. 1.

Family II. Tarantulæ.

With a pedunculated abdomen, each side below furnished with two spiracles, and terminated by a stingless, jointed filament; palpi arm-shaped, with spinous extremities; mandibles monodactyle; anterior feet longer than the others; tongue long and dart-shaped.
Thelyphonus Caudatus, pl. 26, f. 2.

Section II.—Araneides.

Palpi like small feet, ending in a hook; last joint bearing the sexual organs in the male; four or six mamillæ placed near the anal opening, in both sexes, for the purpose of spinning.

I. Tetrapneumones.

Provided with two spiracles, and two pulmonary sacs on both sides.
Mygale Cæmentaria, pl. 26, f. 3.

II. Dipneumones.

Having only one spiracle, and one pulmonary sac, on each side; six spinning orifices; the four exterior quadrangular, and two smaller ones in the middle.

Family I. Tubitelæ.

Spinning orifices fasciculated, approximated, and cylindrical; feet strong.
Aranea Domestica, pl. 26, f. 4.

Family II. Inæquitellæ.

Spinning papillæ converging and conical; feet very

slender; first and last pairs are usually longer than the others; jaws inclined upon the labium.
Scytodes thoracica, pl. 26, f. 5.

Family III. Orbitelæ.

Differing from the preceding family, in the first and second pair of feet being usually longest; the jaws are straight, and wider above.
Epeira diadema, pl. 26, f. 6.

Family IV. Laterigradæ.

When in a state of repose the feet are horizontally extended, four anterior longest and nearly equal; eyes forming the segment of a circle in one division, and in two parallel lines in another.
Thomisus castaneus.

Family V. Citigradæ.

Eyes, eight in number, placed curvilinearly triangular, or ovally truncated. They spin no webs; capture their prey by leaping.
Lycosa Tarantula, pl. 26, f. 8.

Family VI. Saltigradæ.

Legs formed for leaping; eyes either in a single or double quadrangular group, the smaller ones within the other.
Eresus moniligerus.

ORDER II. TRACHEARIÆ.

Without a heart, but in its stead a single dorsal vessel; they respire through a radiated trachea, the air passing through spiracles in the abdomen or thorax; eyes from two to four; some are blind; mouth usually syphon-shaped; sexual organs single.

Family I. Pycnogonides.

With a projecting syphon; four eyes placed on a single tubercle; feet mostly long, terminated by unequal hooks; at the base of the first are two oviferous feet.
Pycnogonon Balænarum, pl. 26, f. 10.

Family II. Pseudoscorpiones.

With very large, pediform palpi, with a didactyle hand or a vascular button.
Chelifer Cancroides, pl. 26, f. 11.

Family III. Phalangita.

With slender filiform palpi, terminated by a hook.
Siro rubens, pl. 26, f. 12.

Family IV. Acarides.

With an oval or globular extremely minute body; generally with two filiform palpi; eyes minute; eight hairy feet, each terminated with two or three hooks.
Trombidium tinctorum, pl. 26, f. 13.

Family V. Hydrachnellæ.

Mouth generally produced and feet adapted for swimming.
Hydrachna geographica, pl. 26, f. 14.

Family VI. Riciniæ.

Mouth produced, legs formed for walking, wandering, or parasitical land animals.
Argas reflexus, pl. 26, f. 15.

Family VII. Microphthira.

Having six legs, and always parasitical.
Leptus Autumnalis, pl. 26, f. 16.

MYRIAPODA.

This class of animals was first formed by Dr. Zeach, after having been placed in different orders by various naturalists before his time. Linnæus arranged them under the apterous insects, under the general name of Iulus and Scolopendra. Fabricius placed them in his class Mitosata; Latreille, Cuvier, and Dumeril, among the insects; and Lamarck, as a division of his class Arachnides.

In their general structure, organization, and in the situation and functions of their respiratory apparatus, the Myriapoda resemble insects. These consist of two air tubes, extending longitudinally and parallel to each other, the whole length of the body, which receive and transmit the air through the medium of numerous lateral spiracles. The animals of this class have a strong resemblance to serpents, their feet being closely approximated throughout the whole extent of their body. The mandibles are bi-articulated, and immediately followed by a quadrifid piece in the form of a lip with articulated divisions resembling little feet, which, from its position, corresponds to the ligula of the Crustacea; there are then two pairs of small feet resembling large hooks; they have two short antennæ, composed of seven joints in some, and, in others, they are numerous and setaceous; their eyes are composed of a union of ocelli, although some have a distinct cornea; the stigmata are very small, consisting of eighteen or twenty annuli; they have two dentated mandibles, fitted for bruising or cutting their food, and divided transversely by a suture, and a lip without palpi, formed of united portions.

The myriapoda live and increase in size longer than insects, as two years are required to render them adult. They are found under stones, the bark of trees, &c., and frequently burrow in the earth: their food consists of vegetable substances. They are generally known by the name of *Millipedes*.

ORDER I. CHILOGNATHA.

The antennæ are filiform, and composed of seven joints; the mouth is provided with two mandibles, and the lip is divided by sutures; two or four anterior feet, united at their base, like pedipalpi; and the spiracles are indistinct.

The body of the animals composing this order is frequently cylindrical, and its covering generally crustaceous; the feet are very short, they walk slowly, and are capable of rolling themselves up into a ball. The first segment of the body is longest, and every segment has usually two pairs of feet: the antennæ are thickest towards the point, or are filiform, very short and seven-jointed; the spiracles are either concealed or indistinct.

Family I. Anguiformia.

Body usually linear, covered with a solid skin, and without any anal appendages: antennæ thickest towards the end; never fewer than thirty-two feet. Body snake-shaped and cylindrical; antennæ, with the second joint longer than the third; legs numerous; there is no ridge or sharp edge on the sides of the rings.
Iulus subulosus, pl. 26, f. 17.

Family II. Penicillata.

The body is oblong and membranaceous, very soft, with ridged scaly sides, and a pencil of ciliated scales at the posterior extremity; antennæ filiform, with twenty-four feet.

The antennæ are short, filiform, moniliform, and inserted under the anterior margin of the head; destitute of palpi; body soft, depressed, and with fasciculi of scales on the sides, and a pencil of ciliated scales at the posterior extremity; having twenty-four feet.
Polyxenus lagurus, pl. 26, f. 18.

ORDER II. CHILOPODA.

The mouth is composed of two mandibles, with a small palpiform appendage, which appears as if it had been soldered in the middle, and terminating in a spoon-like process, with dentated edges; the lip is quadrifid, the two lateral divisions being the longest, and annulated transversely; body depressed, with a coriaceous, membranous, or flexible covering, and each segment provided with a pair of feet; antennæ setaceous, composed of numerous joints; spiracles distinct.

Family I. Inæquipedes.

Body elongated, but not worm-shaped or linear, divided below into fifteen segments, each provided with a pair of feet, and covered above with eight plates or half segments in the form of scutelli and concealing the spiracles; feet elongated, especially the last pair, with a very long and jointed tarsus; eyes large and compound.

The antennæ are many-jointed and setaceous, and greatly longer than the head; mandibles two, with slender palpi adhering to the back of the internal lip; the posterior lip provided with two strong-pierced hooks; body elongated, linear; having thirty feet.

Scutigera araneoides, pl. 26, f. 19.

Family II. Æquipedes.

Body vermiform and linear, with the segments equal both above and below; feet equal, with the exception of the two last, which are long, and form a kind of tail; eyes granulated; spiracles lateral.

The stigmata are lateral; the body divided into a similar number of segments, both above and beneath, each bearing a pair of feet; the superior plates alternately longer and shorter, and overlapping each other close to the extremity; fifteen pairs of feet.

Lithobius forficatus, pl. 26, f. 20.

The antennæ cornicosetaceous, consisting of seventeen subconic joints; mouth covered by hemispheric galeæ; exterior palpi, with a double peduncle; mandibles strong and horny; the upper lip cleft; segments of the body margined; anterior pair of feet small, the last pair being largest; eight eyes, four on each side of the head, arranged in a rhomboidal form.

Scolopendra morsitans, pl. 26, f. 21.

INSECTS.

ORDER I.—THYSANOURA.

These are apterous insects, with six feet, and undergo no metamorphosis; head distinct; two antennæ, which are longer than the head; abdomen with a terminal forked or filamentary tail.

Family I. Lepismenæ.

Antennæ with many small joints; palpi produced; abdomen provided with a series of moveable appendages on each side.

Machilis polypoda, pl. 28, f. 1.

Family II. Podurellæ.

Antennæ four-jointed; mouth destitute of palpi; no lateral appendages on the abdomen; tail forked (used in leaping) while in repose it is folded under the abdomen.

Podura Plumbea, pl. 28, f. 2.

ORDER II. PARASITA.

With six feet; no abdominal appendages; two or four small eyes; exterior mouth, nipple or snout-shaped, inclosing a retractile sucker; sometimes having membranous lips, with doubly hooked mandibles.

Family I. Mandibulata.

Having two lips, mandibles, and jaws.

Ricinus corvicoracis, pl. 28, f. 3.

Family II. Siphunculata.

No mandibles; mouth consisting of a beak, from which a sucker can be protruded at will.

Pediculus coturnicis, pl. 28, f. 4.

ORDER III. SYPHONAPTERA.

With a compressed body; mouth provided with a two-pieced sucker, inclosed between two articulated laminæ; these form a conical or cylindrical beak, covered with scales at the base.

It consists of but one genus, Pulex irritans, pl. 28, f. 5. With an oval compressed body, consisting of twelve segments; three of which compose the thorax, and the remaining the abdomen; six feet; beak, jointed, consisting of two plates inclosing a sucker.

ORDER IV. COLEOPTERA.

Having four crustaceous elytra or wings, the two upper ones in the form of cases, and covering the under ones when at rest, which are folded across; they are provided with mandibles and jaws for mastication; the suture betwixt the elytra straight.

Section I.—PENTAMERA.

Tarsi with five joints.

Family I. Adephagi.

Each jaw with two palpi, in all six; antennæ generally filiform, and simple.

Tribe I. Cicendeletæ.—Terrestrial.

With strong dentated mandibles; labium small, concealed by the chin; labial palpi four-jointed; jaws unguiculated, or ending in a spine or point; eyes produced; tarsi long and slender.

Cicendela octonotata, pl. 28, f. 6.

Tribe II. Carabici.

Mandibles rarely dentated; labium produced; extremities of the jaws arched or hooked, and sometimes nearly straight; no articulated spine.

Brachinus Jurinæ, pl. 28, f. 7.

Tribe III. Hydrocanthari.—Aquatic.

With seven-jointed, filiform antennæ, longer than the head, inserted near the labium; exterior palpi filiform; two eyes; tarsi five-jointed.

Colymbetes marmoratus, pl. 28, f. 8.

Tribe IV. Gyrinites.

With claviform antennæ shorter than the head; four eyes; anterior feet long, advancing; four posterior ones, membranous, broad, and fin-shaped; joints of tarsi laterally dilated.

Gyrinus sulcatus, pl. 28, f. 9.

Family II. Brachyptera.

Body elongated, narrow; antennæ moniliform; each jaw provided with a palpus; elytra shorter than the abdomen, but covering the wings; anal appendages hairy.

Tribe I. Fissilabri.

Head appearing as if separated from the body by strangulation, with a deeply notched labrum.
Oxyporus rufus, pl. 28, f. 10.

Tribe II. Longipalpi.

Head much separated from the body; an entire labrum; maxillary palpi length of the head, fourth joint concealed.
Pæderus ruficollis, pl. 28, f. 11.

Tribe III. Depressi.

Maxillary palpi short, fourth joint projecting; head in most males horned; tarsi with three joints, last very long.
Lesteva dichroa, pl. 28, f. 12.

Tribe IV. Microcephali.

Head concealed in the thorax nearly to the eyes; thorax widening backwards trapeziform.
Tachinus atricapillus, pl. 28, f. 13.

Family III. Serricornes.

With filiform or setaceous antennæ, tufted, serrated, or pectinated in the males; some ending in a toothed club; upper part of abdomen covered by the elytra, except in one genus; tarsial penult joint frequently bilobed.

Tribe I. Buprestides.

Body ovate; short and serrated antennæ; eyes oval; palpi filiform; thorax short and broad; first four joints broad, triangular, cordiform, penult one bilobed.
Buprestis rufipes, pl. 28, f. 14.

Tribe II. Elaterides.

Body linear, depressed; mandibles notched, or bifid at their points; maxillary palpi with a triangular terminal joint; angles of the thorax toothed.
Elater areolus, pl. 28, f. 15.

Tribe III. Cebrionites.

Mandibles terminating in a simple point; palpi filiform; body oval or oblong, arched above, sometimes hemispherical.
Rhipicera cyanea, pl. 29, f. 16.

Tribe IV. Lampyrides.

Body straight; thorax depressed, semicircular or square, overshooting the head; maxillary palpi thickest at their extremity; mandibles small, acute; penult joint of tarsi bilobed.
Lampyris Savignyi, pl. 28, f. 17.

Tribe V. Melyrides.

Body oblong, back depressed, thorax nearly square; elytra flexible; mandibles notched at tip and elongated; palpi filiform, short; head covered at the base; joints of tarsi entire.
Malachius æneus, pl. 29, f. 18.

Tribe VI. Clerii.

Body cylindrical; head sunk in thorax; mandibles bifid at their tips; antennæ filiform, serrated, and knobbed; palpi claviform; penult joint of tarsi bilobed; eyes internally notched at base of antennæ.
Opilo mollis, pl. 29, f. 19.

Tribe VII. Xylotrogi.

Body long, linear, head globular, neck distinct; mandibles short, thick, dentated; antennæ and tarsi filiform, last joint bilobed; in some the elytra very short.
Hyleocœtus Dermestoides.

Tribe VIII. Ptiniores.

Body ovoid, both ends rounded, convex above; head somewhat concealed in the thorax; mandibles short and dentated; antennæ simple, filiform, setaceous or flabelliform, and serrated or pectinated; palpi short, thick at the points; tarsi short.
Anobium tesselatum, pl. 28, f. 20.

Family IV. Clavicornes.

With four palpi, elytra nearly covering the abdomen; antennæ eleven jointed, knobbed at their points; tarsi five-jointed.

Tribe I. Hystroida.

Head posteriorly sunk in the thorax; mandibles strong, protruding, points prolonged; elytra truncated; feet contractile; body square.
Hololepta glabra, pl. 28, f. 22.

Tribe II. Peltoides.

Head sunk in the thorax; maxillary palpi shorter than the head; elytra not covering the abdomen entirely.
Necrophorus mallei, pl. 28, f. 23.

Tribe III. Palpatores.

Head ovoid, apart from the thorax, which is narrower than the head; maxillary palpi length of head, tumid at their points; abdomen ovoid, covered by the elytra.
Mastigus palpalis.

Tribe IV. Dermestini.

Antennæ abruptly claviform; legs straight; mandibles short, thick, and arched; feet short, not contractile; body ovoid; palpi short, filiform.
Dermestus lardarius, pl. 28, f. 26.

Tribe V. Byrrhi.

Antennæ filiform, thickened at tips; legs broad; feet contractile; upper extremity of pre-sternum dilated.
Byrrhus pilula, pl. 28, f. 27.

Tribe VI. Macrodactyli.—Aquatic.

Tarsi generally four-jointed; sternum dilated in front; antennæ six or seven-jointed, some ten or twelve, fusiform or cylindrical, not larger than head; tarsi with a broad termination and two hooks.
Heterocerus marginatus, pl. 29, f. 28.

Family V. Palpicornes.

Antennæ compressed, six or nine-jointed, with a perfoliated or solid claviform termination; body hemispherical, or ovoid; mentum large; maxillary palpi long.

Tribe I. Hydrophilii.

Feet fitted for swimming; first joint of tarsi indistinct; jaws all corneous; mandibles bidentated, or entire at their tips; thorax broader than long.
Hydrophilus caraboides, pl. 29, f. 29.

Tribe II. Sphæridiota.

Legs spinous; feet fitted for walking; tarsi five-jointed, first and second same length; jaws with two terminal lobes; body hemispherical; maxillary palpi tumid.
Sphæridium scarabæoides, pl. 29, f. 30.

Family VI. Lamellicornes.

Antennæ eight to eleven jointed, but nine or ten the prevailing number, placed in a furrow, short and claviform, consisting of pectinated laminæ; two anterior legs externally dentated; chin large, frequently covering the labium.

Tribe I. Scarabæides.

Antennæ claviform and laminated, the first cup-shaped enveloping the rest.
Oryctes Chevrolatii, pl. 28, f. 31.
The animals of this tribe are numerous, subject to great variety, and are, in consequence, arranged in six sub-tribes.

Tribe II. Lucanides.

Antennæ ten-jointed, club-leaflets perpendicularly pectinated.
Lucanus cinnamoneus, pl. 28, f. 32.

Section II.—HETEROMERA.

First four tarsi five, and two last four-jointed.

Family I. Melasoma.

Tarsial joints mostly entire; antennæ moniliform, third joint elongated, always inserted under the projecting borders of the head; point of mandibles bifid; internal side of jaws with a tooth or hook.

TRIBE I. PIMELIARIÆ.

Apterous; elytra crusted and cover the abdomen, maxillary palpi filiform, or terminated by a somewhat enlarged joint.
Pimelia vestita, pl. 28, f. 33.

TRIBE II. BLAPSIDES.

Maxillary palpi triangular or dolabriform, with the terminal joints larger than the preceding.
Blaps mortisaga, pl. 28, f. 34.

TRIBE III. TENEBRIONITES.

Having wings, and the elytra free.
Crypticus gibbulus, pl. 28, f. 35.

FAMILY II. TAXICORNES.

Mandibles bifid at their points; joints of tarsi, except the anterior four, entire; antennæ length of head and thorax, with claviform tips, and usually partly perfoliated.

TRIBE I. DIAPERIALES.

Antennæ somewhat perfoliated, claviform; thorax and elytra not margined at the sides.
Diaperis boleti, pl. 28, f. 36.

TRIBE II. COSSYPHENES.

Body depressed, clypeiform, laterally bordered by the sides of the elytra and thorax, under which the head is sunk.
Cossyphenes Hoffmanseggi, pl. 28, f. 37.

TRIBE III. CRASSICORNES.

Antennæ abruptly claviform, perfoliated or compressed, internal side somewhat serrated.
Cnodalon nodosum, pl. 28, f. 38.

FAMILY III. STENELYTRA.

Mandibles sometimes pointed, jaws unarmed; penult joint of tarsi bilobate, antennæ, filiform or setaceous, often longer than the head and thorax.

TRIBE I. HELOPII.

Mandibles bifid; base of antennæ usually covered by the projecting margin of the head; maxillary palpi longer than the labial, terminal joint triangular, tarsial joints entire, hook of the last simple.
Helops violaceus, pl. 28, f. 39.

TRIBE II. CISTELIDES.

Mandibles ending in a simple point; terminal joint of tarsi hooked, penult joint sometimes bilobed.
Cistela sulphurea, pl. 29, f. 40.

TRIBE III. SECURIPALPI.

Terminal joint of maxillary palpi serrated, dolabriform or cultriform; penult joint of four anterior tarsi bilobed and conical; body oblong; head much inclined; thorax same breadth as elytra; antennæ usually short.
Melandrya caraboides.

TRIBE IV. ŒDEMERITES.

Mandibles bifid; tarsial penult joints bilobed; last joint of maxillary palpi large; antennæ filiform or setaceous, placed near the eyes, mostly elongated and serrated; body elongated, narrow, with a cylindrical thorax; elytra frequently flexible.
Œdemera podograria, pl. 29, f. 42.

TRIBE V. RHYNCHOSTOMA.

Anterior part elongated into a snout.
Stenostoma rostrata.

FAMILY IV. TRACHELIDES.

With a cordiform, triangular head, apart from the thorax; antennæ simple, flabelliform, pectinated, or serrated; jaws without corneous teeth; tarsial hooks entire; penult joint usually bilobed.

TRIBE I. LAGRIARIÆ.

Tarsial penult joint bilobed; terminal joint of maxillary palpi large, triangular; antennæ filiform, frequently granulated, sometimes thickening towards the tips; terminal joints in males longer than the preceding; thorax cylindrical or square.
Lagriaria hirta.

TRIBE II. PYROCHROIDES.

Tarsial hooks simple; body oblong, straight, and depressed; thorax round or triangular; elytra length of abdomen, with a rounded termination; maxillary palpi, slightly serrated, labial filiform; antennæ flabelliform or pectinated.
Pyrochroa coccinea, pl. 29, f. 45.

TRIBE III. MORDELLONÆ.

Body arcuated, head low; thorax semicircular; elytra usually short, ending in a point; antennæ serrated, and in the males pectinated or tufted; palpi variously formed.
Mordella aculeata, pl. 28, f. 46.

TRIBE IV. ANTHICIDES.

Penult joint of tarsi bilobed; body oblong, thorax cordiform, divided into knots; terminal joint of maxillary palpi longer than the preceding; antennæ simple or slightly serrated; filiform or thickening towards the ends.
Notoxus monoceros, pl. 29, f. 47.

TRIBE V. HORIALES.

Tarsial joints ending in two dentated hooks, along with a bristle; body oblong, thorax square; palpi filiform.
Horia maculata, pl. 28, f. 48.

TRIBE VI. CANTHARIDIÆ.

Tarsial hooks bifid; penult joint rarely bilobed; antennæ simple, or slightly serrated; head inclined; palpi filiform, sometimes thicker at the tips.
Cantharis vesicatoria, pl. 28, f. 49.

Section III.—TETRAMERA.

All the tarsi four-jointed.

FAMILY I. RHYNCHOPHORA.

Head rostriform, mouth terminal; antennæ generally claviform, geniculate, and inserted on the proboscis; abdomen large; penult joint of tarsi usually bilobate.

TRIBE I. BRUCHELÆ.

Antennæ filiform, thicker towards the points; serrated or pectinated; joints as broad, or broader than long; labrum breadth of head; eyes oblong, transverse, generally lunate; posterior legs long; third joint of tarsi distinct; thorax posteriorly lobed; abdomen large.
Bruchus pisi, pl. 29, f. 50.

TRIBE II. ANTHRIBIDES.

Antennæ long-jointed, with a claviform termination; labrum very small; eyes globular or oval.
Anthribus latirostris, pl. 29, f. 51.

TRIBE III. ATTELABIDES.

Tarsial penult joint bilobed; antennæ claviform, straight, inserted in the rostrum, body contracted in front, ovoid or oval.
Attelabus femoralis.

TRIBE IV. BRENTIDES.

Tarsial penult joint bilobed; antennæ eleven-jointed, straight, inserted in the rostrum, which is long, filiform, or gradually thickening towards the points; body linear, much elongated.
Brentus anchorago, pl. 29, f. 52.

TRIBE V. CURCULIONITES.

Tarsial penult joint sometimes entire, or slightly bilobate; antennæ claviform, geniculate; rostrum generally bent downwards.
Curculio imperialis, pl. 28, f. 53.

FAMILY II. XYLOPHAGI.

Tarsial joints usually entire, or when the penult joint is bilobed, the palpi are small and conical; antennæ frequently with less than eleven joints, claviform, and perfoliated at the base.

TRIBE I. SCOLYTARII.

Antennæ less than eleven joints; body subovoid, cylindrical, linear, or clypeiform; thorax breadth of

abdomen; palpi small; antennæ with five free joints before the club; palpi very small and conical; penult joint of tarsi bilobed in some species.
Scolytus ulmi, pl. 29, f. 54.

TRIBE II. BOSTRICHINI.

Antennæ claviform, less than eleven-jointed; body ovoid, or cylindrical; maxillary palpi filiform, sometimes thickening towards the points.
Bostrichus capucinus, pl. 29, f. 55.

TRIBE III. PAUSSILI.

Body oblong, depressed; contracted in front; tarsi five-jointed, entire; palpi conical; antennæ, in some species, only two-jointed, in others ten cylindrically claviform, with perfoliated base; elytra truncated.
Paussus microcephalus, pl. 28, f. 56.

TRIBE IV. TROGOSSITARII.

Antennæ eleven-jointed, some perfoliated, others not longer than the head.
Dasycerus sulcatus, pl. 29, f. 57.

FAMILY III. PLATYSOMA.

Tarsial joints entire; body depressed, oblong; head breadth of body, narrowed behind into a sort of peak; mandibles projecting, especially in the males; labrum small; palpi short; thorax nearly square; antennæ filiform.
Cucujus Dejeanii, pl. 28, f. 58.

FAMILY IV. LONGICORNES.

First three joints of tarsus provided with pencils below, two intermediate broad, triangular, or cordiform, third deeply bifoliate; labium triangular, cordiform, or notched; antennæ filiform, generally longer than the body, sometimes inserted in a notch at the eyes, sometimes outside; foot long, slender, with long tarsi; body elongated.

TRIBE I. PRIONII.

Head concealed in the thorax to the eyes; last joint of palpi truncated; wings folded under the elytra; labrum very small or none; body usually depressed, lateral borders of thorax edged, dentated, or spinous; antennæ serrated or pectinated in the males.
Prionis coriarius, pl. 28, f. 59.

TRIBE II. CERAMBYCINI.

With a very distinct labrum.
Cerambyx hirtipes, pl. 28, f. 60.

TRIBE III. NECYDALIDES.

Wings extended nearly their whole length, slightly folded at their extremity; elytra very short and truncated; body narrow and elongated.
Necydalis major, pl. 29, f. 61.

TRIBE IV. LAMIARIÆ.

Terminal joint of palpi ovate, contracted into a point; head verticle.
Saperda albicans, pl. 28, f. 62.

TRIBE V. LEPTURETÆ.

Antennæ inserted beyond the eyes; head oval, abruptly compressed towards the base; thorax conical or trapeziform; abdomen nearly triangular; antennæ often approximate between the eyes.
Leptura annulata, pl. 29, f. 63.

FAMILY V. EUPODA.

Body oblong, antennæ filiform, gradually thickening to the points, and inserted near the eyes; about the length of head and thorax, which is narrow, cylindrical, or square; head sunk in the thorax to nearly the eyes; exterior and terminal lobe of jaws widening towards the extremity.

TRIBE I. SAGRIDES.

With a deeply notched labium; mandibles entire at the tips.
Sagra Cayanea, pl. 29, f. 64.

TRIBE II. CRIOCERIDES.

Labium entire, no notch; mandibles bifid, or bidented at their tips.
Crioceris merdigera, pl. 28, f. 65.

FAMILY VI. CYCLICA.

Labium thick, square, or oval, entire, or slightly notched; exterior and terminal division of jaws cylindrical; body oval, ovoid, globular, or somewhat square; antennæ filiform or setaceous, sometimes slightly claviform, but not rounded or oval; three first joints of tarsi spongy, or provided with brushes below.

TRIBE I. CASSIDARIÆ.

Antennæ placed on the upper part of the head, approximate, short, straight, projecting, frequently nearly cylindrical; mouth low; palpi very short; tarsi short, flat; body orbicular, flat beneath, margined by the elytra and thorax.
Cassida viridis, pl. 28, f. 66.

TRIBE II. CHRYSOMELINÆ.

Antennæ remote, placed before the eyes.
Chlamys cuprea, pl. 29, f. 67.

TRIBE III. GALERUCITÆ.

Antennæ placed between the eyes, near the mouth, and approximate at their base.
Galeruca tanaceti.

FAMILY VII. CLAVIPALPI.

Three first joints of tarsi with brushes, and the last bifid; antennæ with a terminal, oval, perfoliated club; jaws with a horny tooth interiorly; palpi with a large terminal joint; body orbicular or oval.
Erotylus giganteus, pl. 28, f. 69.

Section IV.—TRIMERA.

Tarsi three-jointed; antennæ clavate; body hemispherical or oval.

FAMILY I. APHIDIPHAGI.

Tarsi with two terminal hooks, first joint distinct; elytra covering the abdomen; antennæ shorter than the thorax, with a terminal club in the form of a reversed triangle; last joint of maxillary palpi being large, dolabriform; body hemispherical; thorax short, and nearly luniform.
Cocinella septempunctata, pl. 28, f. 70.

FAMILY II. FUNGICOLÆ.

Tarsi with two terminal hooks, the first joint distinct, elytra covering the abdomen; antennæ longer than the head and thorax; maxillary palpi filiform, or simply thickened towards the tips; body oval.
Eumorphus tetraspilotus, pl. 29, f. 71.

FAMILY III. PSELAPHII.

With short truncated elytra; first tarsial joint short and indistinct.
Chennium bituberculatum, pl. 29, f. 72.

Section V.—MONOMERA.

Tarsi having but one joint.

FAMILY I. DERMESTINI.

Antennæ shorter than the thorax, radical joint large, ovate, seven following short, slender, remaining three forming an ovate compressed club, two lower joints somewhat dilated in the inner side, terminal smaller and rounded.

ORDER V.—ORTHOPTERA.

With coriaceous elytra, the margin of the one covering that of the other; mouth provided with mandibles; wings longitudinally folded, and sometimes transversely besides; metamorphosis semi-complete.

Section I.

Elytra and wings horizontal; feet formed for running.

FAMILY I. FORFICULARIÆ.

Tarsi three-jointed; elytra nearly crustaceous, and

reticulated, very short, posteriorly truncate, joining in a straight suture, and covering the wings, which are plicated, and their extremities projecting beyond the elytra, while in repose; abdomen terminating in a horny forceps.
Forficula spongiphora, pl. 28, f. 73.

FAMILY II. BLATTARIÆ.

Tarsi five-jointed; wings simply doubled longitudinally, and covered by elytra, frequently coriaceous and thin, reticulated or crossing each other; body depressed, oval, or orbicular; head concealed under the semicircular or orbicular thorax; maxillary palpi long, terminal joint axe shaped; feet spinous.
Blatta maculata, pl. 28, f. 74.

FAMILY III. MANTIDES.

Tarsi five-jointed; wings simply folded longitudinally; body elongated, head uncovered; palpi short, filiform; two anterior feet greatly longer than the others, haunches long, thighs strong, compressed; legs terminated by a strong hook, capable of being folded under the thighs; thorax large.
Mantis religiosa, pl. 28, f. 75.

FAMILY IV. SPECTRA.

Under lip unequally divided; anterior margin of upper lip notched; antennæ placed nearer the mouth than the centre of the head; head projecting, elongated, and posteriorly rounded; eyes small; first segment of the thorax short, being scarcely longer than the second
Phyllium psama, pl. 29, f. 76.

Section II

With the exception of the first family, the elytra and wings are sloping like a roof; posterior thighs and feet very large, and formed for leaping.

FAMILY I. GRYLLIDES.

Elytra and wings horizontal; antennæ setaceous or filiform, tarsi three-jointed.
Gryllus trifasciatus, pl. 28, f. 77.

FAMILY II. LOCUSTARIÆ.

Elytra and wings sloping like a roof; tarsi four-jointed, antennæ setaceous.
Locusta viridissima, pl. 29, f. 158.

Section III.

Elytra and wings sloping like a roof: posterior feet formed for leaping; tarsi five-jointed; elytra alike in both sexes; antennæ sword-shaped, filiform in both sexes, claviform in the males only, in some species.

ACRIDITES.

Posterior feet weak, shorter than the body, hardly formed for leaping; abdomen turned.
Acridium ornatum, pl. 28, f. 78.

ORDER VI. HEMIPTERA.

Two wings covered by elytra; mouth constructed for suction; the rostrum composed of a tubular articulated sheath, enveloping four scaly setæ, instead of mandibles and jaws; elytra in some of the species crustaceous, with the posterior extremity membranous; in others nearly similar to wings, but more extended, thicker, and coloured.

Section I.—HETEROPTERA.

Rostrum placed on the anterior extremity of the head; elytra and wings horizontal, terminated abruptly by a membranous appendage.

FAMILY I. GEOCORISÆ.

Antennæ placed near the internal margin of the eyes, and somewhat longer than the head; tarsi three-jointed, the first of some species very short.

TRIBE I. LONGILABRA.

Sheath of sucker four-jointed; labrum long, subulate, and striated above.
Scutellera vasalis, pl. 28, f. 79.

TRIBE II. MEMBRANACEÆ.

Sheath of sucker two or three-jointed, labrum short; feet hooked, inserted in the medial line under the thorax; rostrum straight, sheathed at its base, or in its whole length; head not posteriorly narrowed; eyes of medium size.
Cinex lectularius, pl. 28, f. 80.

TRIBE III. NUDICOLLIS.

Rostrum free, arcuated; head abruptly narrowed at its insertion like a neck.
Reduvius raptatorius, pl. 28, f. 81.

TRIBE IV. OCULATÆ.

Rostrum free, usually straight; eyes large; labrum projecting.
Leptopus littoralis.

TRIBE V. PLOTERES.

Four posterior feet long, slender, formed for walking on the ground or water; placed on the sides of the breast, and much apart; tarsi with two small hooks, which are placed in a lateral fissure at their end; body covered with silky down.
Hydrometra linearis, pl. 29, f. 82.

FAMILY II. HYDROCORISÆ.

Antennæ placed under the eyes, concealed, and even longer than the head; tarsi two-jointed.

TRIBE I. NEPIDES.

Anterior feet formed for seizing; thighs large, furrowed beneath to receive the margin of the leg; tarsi short, rivetted at their origin with the legs, and forming together a large hook; body oval, much depressed, or linear.
Belostoma marginata, pl. 28, f. 84.

TRIBE II. NOTONECTIDES.

Two anterior feet bent downwards, thighs of ordinary size; tarsi ciliated; two posterior feet oar-shaped, ciliated, with two very small terminal hooks; body nearly cylindrical or ovoid.
Noctonecta glauca, pl. 28, f. 85.

Section II.—HOMOPTERA.

Rostrum projected from the lower part of the head, between the two anterior feet; elytra generally inclined, of equal thickness throughout, sometimes resembling wings.

FAMILY III. CICADARIÆ.

With wings and elytra; tarsi three-jointed; antennæ small, conical, or subulate; three to six-jointed, including the setæ, which terminate them; female ovipositor dentated.

TRIBE I. STRIDULANTES.

Eyes three, small and smooth; antennæ six-jointed; males with a drum, or musical organ, interiorly, on each side the abdomen, covered by an operculum.
Cicada flavopunctata, pl. 28, f. 86.

TRIBE II. FULGORELLÆ.

With two eyes; antennæ three-jointed, terminal setæ compressed, placed under the eyes; front frequently prolonged into a beak.
Fulgora punctata, pl. 28, f. 87.

TRIBE III. MEMBRACIDES.

With two eyes; antennæ three-jointed, placed between the eyes; thorax prolonged behind, and covering part of the back; in some species dilated at the sides of the head.
Darnis Camelus, pl. 28, f. 88.

TRIBE IV. CICADELLA.

Thorax laterally dilated; in other respects like the preceding tribe.
Ledra aurata, pl. 28, f. 83.

Family IV. Hymenelytra.

Tarsi two-jointed, generally with two terminal hooks, or simply vesicular; antennæ ten or eleven-jointed, longer than the head; body soft.

Tribe I. Psyllides.

Antennæ terminated by two setæ; elytra and wings sloping; tarsi two-jointed, with two terminal hooks; females provided with an ovipositor.
Livia juncorum, pl. 28, f. 90.

Tribe II. Physapi.

Antennæ eight-jointed; elytra and wings linear; second tarsial joint replaced by a vesicle, destitute of hooks.
Thrips physapus, pl. 28, f. 91.

Tribe III. Aphidii.

Antennæ six or seven-jointed; elytra and wings triangular, sloping, and without fringes; tarsi two-jointed, first short, second with two terminal hooks.
Aphis rosiæ, pl. 28, f. 92. f. 92 *a*, larva of the same.

Family V. Gallinsecta.

Tarsi of one joint, with a terminal hook. Males two winged, or with two elytra, and devoid of a rostrum. Females apterous; antennæ eight, nine, and eleven-jointed, and in some instances twenty-two to twenty-four.
Coccus cacti, pl. 28, f. 93.

ORDER VII. NEUROPTERA.

Wings four, naked, reticulated and transparent; mouth formed for mastication; jaws and lips straight, extended; joints of the tarsi various, mostly entire.

Section I.—SUBULICORNES.

Antennæ little longer than head; subulate, seven-jointed, the last formed of a seta; mandibles and jaws covered by lips, or by an anterior projection of the head; eyes projecting, large; wings extended horizontally, or perpendicular.

Family I. Libellulinæ.

Tarsi three-jointed; mandibles and jaws corneous, very strong; dentated; wings equal.
Libellula varia, pl. 28, f. 94.

Family II. Ephemerinæ.

Tarsi four-jointed; body very soft; lower wings much smaller than the upper ones, in some species exceedingly minute; abdomen terminated by two or three filaments.
Ephemera bioculata, pl. 28, f. 95.

Section II.—FILICORNES.

Joints of antennæ generally numerous, thickened towards the end, filiform, or setaceous, and longer than the head.

Family III. Planipennes.

Tribe I. Panorpatæ.

Tarsi five-jointed; antennæ setaceous or filiform; front of the head produced into a beak; lower wings sometimes long and narrow.
Panorpa rufa, pl. 28, f. 96.

Tribe II. Myrmeleonides.

Tarsi five-jointed; antennæ thickened towards the end; prothorax short, in the form of a collar; wings sloping like a roof; each jaw with two palpi.
Ascalaphus barbarus, pl. 28, f. 97.

Tribe III. Hemerobini.

Wings four, equal, deflexed; first segment of trunk very short; tarsi five-jointed; with four palpi; antennæ filiform or setaceous.
Hemerobius longicornis, pl. 29, f. 98.

Tribe IV. Psoquillæ.

Wings unequal, deflexed, lower ones smallest; tarsi two or three-jointed; antennæ ten-jointed; labial palpi very short.
Psocus bipunctatus.

Tribe V. Termitinæ.

Tarsi four-jointed; antennæ short, moniliform; wings usually horizontal, longer than the body; first segment of the trunk large, semicircular; jaws scaly, pointed.
Termes lucifugum.

Tribe VI. Raphidinæ.

Tarsi four or five-jointed; prothorax elongated, cylindrical; wings equal, deflexed, greatly reticulated, lower ones not bent at their internal margin; antennæ filiform or nearly setaceous, sometimes short and granulated; palpi filiform, or somewhat thickened at the points.
Raphidia ophiopsis.

Tribe VII. Semblides.

Tarsi five-jointed; prothorax ample; wings horizontal or deflexed, internal side of the lower bent, or folded below; antennæ filiform or setaceous, sometimes pectinated; maxillary palpi projecting, slender towards the points; last joint often short.
Corydalis cornuta.

Tribe VIII. Perlides.

Tarsi three-jointed; prothorax square; body narrow, elongated, depressed; wings horizontal; abdomen terminated by two setæ; mandibles small, partly membranous.
Perla lutea.

Family IV. Plicipennes.

Destitute of mandibles; lower wings broader than the upper, longitudinally folded; antennæ setaceous, usually long, with numerous joints; tarsi five-jointed; maxillary palpi long and setaceous.
Phryganea striata.

ORDER VIII. HYMENOPTERA.

Four naked veined wings of unequal size; mouth with jaws, mandibles, and two lips; lip tubular at its base, terminating by a labium, either doubled or folded inwards, and forming a kind of sucker; females provided with a compound ovipositor.

Section I.—TEREBRANTIA.

Abdomen in many species sessile; females furnished with an ovipositor; antennæ twelve or thirteen jointed, in some more or less.

Family I. Securifera.

Abdomen perfectly sessile, or connected at its base to the metathorax.

Tribe I. Tenthredinetæ.

Maxillary palpi six-jointed; labial palpi four-jointed: mandibles long, compressed; labium trifid; ovipositor compound.
Perga scutellata, pl. 29, f. 101.

Tribe II. Urocerata.

Maxillary palpi, with two to five joints; labial palpi three; mandibles short, thick; labium entire; antennæ vibratile; head nearly globular.
Termex columba, pl. 29, f. 102.

Family III. Pupivora.

Wings of many species cellular, in others devoid of nerves; first abdominal segment posteriorly inclosing the metathorax, and forming part of it; the second, which appears like the first, fixed to the preceding by a pedicle.

TRIBE I. EVANIALES.

Abdomen placed on the thorax above the two posterior feet, in others nearly under the scutellum; wings veined, upper ones cellular; antennæ filiform or setaceous, thirteen or fourteen-jointed; maxillary palpi frequently very apparent; ovipositor in most species projecting, consisting of three filaments.
Pelecinus policerator, pl. 29, f. 103.

TRIBE II. ICHNEUMONIDES.

Abdomen projected from between the two posterior feet; the four wings veined, upper ones inclosed, or with discoidal cells; maxillary palpi apparent and projecting; ovipositor with three filaments; antennæ setaceous or filiform, rarely elevated, and many-jointed.
Ichneumon unifasciatorius, pl. 28, f. 104.

TRIBE III. GALLICOLÆ.

Lower wings with one nerve; upper, one radial cell, two or three cubital; antennæ uniformly thick, or thickening towards the point, thirteen to fifteen-jointed; palpi short; ovipositor spirally rolled up.
Cinips quercus-folii.

TRIBE IV. CHALCIDITES.

Lower wings nerveless; no cubital cell in the upper; palpi very short; antennæ thickened at the ends, claviform in some, geniculated, joints never exceeding twelve, ovipositor contained in the abdomen; posterior legs formed for leaping.
Chalcis clavipes, pl. 28, f. 106.

TRIBE V. CHRYSIDES.

Lower wings with longitudinal ribs, in the upper ones a radial cell, and a large cubital one; antennæ filiform; thirteen-jointed; ovipositor internal, exsertile, sharp-pointed; abdomen sessile, flat beneath, and can be folded on the breast; palpi apparent, body globular.
Chrysis ignita, pl. 28, f. 107.

TRIBE VI. OXYURI.

Lower wings single nerved; upper in many devoid of discoidal and radial cells; antennæ filiform, ten to fifteen-jointed, or thickened towards the points in females; maxillary palpi long; abdominal segment large; ovipositor tubular, formed by the extremity of the abdomen.
Bethyllus hemipterus.

Section II.—ACULEATA.

Abdomen pedunculated, inclosing in the females and neuters a sting; antennæ of the male thirteen-jointed, female twelve.

FAMILY III. HETEROGYNA.

Females and neuters, or those which live in society, devoid of wings; antennæ geniculated; labium small, rounded, vaulted.

TRIBE I. FORMICARIÆ.

Males and females winged, neuters apterous.
Formica Herculanea, pl. 28, f. 109.

TRIBE II. MUTILLARIÆ.

Females apterous, and feet strong, legs spinous and ciliated; antennæ filiform or setaceous, first and third joint elongated.
Mutilla Klugii, pl. 28, f. 110.

FAMILY IV. FOSSORES.

Wings extended; in some the prothorax laterally prolonged; in others short.

TRIBE I. SCOLIETÆ.

Anterior segment of trunk laterally prolonged to the insertion of the wings; antennæ of females close-jointed; feet thick, spinous; thighs arcuated; antennæ straight, length of head and thorax in males, shorter and arcuated in females, in the upper wings of some a radial cell.
Scolia tricincta, pl. 29, f. 111.

TRIBE II. SAPYGITES.

Feet in both sexes slender, slightly spinous or ciliated, in some smooth; antennæ length of head and thorax.
Sapyga prisma.

TRIBE III. POMPILII.

Prothorax square, either transverse or longitudinal; posterior margin nearly straight; abdomen somewhat ovoid, narrow at its base; inside of two posterior legs with a pencil of hair.
Pompilus viaticus, pl. 28, f. 113.

TRIBE IV. SPHEGIDES.

Prothorax forming a jointed neck, narrowed in front; base of abdomen produced into a long pencil; three complete cubital cells.
Podium nigripes, pl. 29, f. 114.

TRIBE V. BEMBECIDES.

Labium quite apparent, or much produced.
Bembex rostrata, pl. 29, f. 115.

TRIBE VI. LABRATÆ.

Labrum quite concealed, or scarcely perceptible; abdomen conical, or conically ovoid; mandibles deeply notched on the lower side.
Labra Ichneumoniformis.

TRIBE VII. NYSSONII.

Mandibles without notch; labrum concealed, or hardly perceptible; abdomen ovoid or conical.
Nysson maculatus.

TRIBE VIII. CRABRONITES.

Labrum hid, or not protruding; abdomen oval or elliptical, increasing from the base to the extremity, claviform; head frequently very large.
Crabro cribrarius, pl. 29, f. 118.

FAMILY V. DIPLOPTERA.

Wings longitudinally folded; antennæ geniculate, clavate; eyes notched; prothorax reaching insertion of upper wings; feet not fitted for collecting pollen.

TRIBE I. VESPARIÆ.

Antennæ twelve or thirteen-jointed, coniform, and pointed; labium sometimes divided into four plumose filaments, sometimes trilobed, with four glandular points.
Synagris cornuta, pl. 29, f. 119.

TRIBE II. MASARIDES.

Antennæ eight or ten-jointed, button-shaped at tip; labrum with two filaments at its termination, retiring into a tube formed by the base.
Masaris apiformis, pl. 29, f. 120.

FAMILY VI. MELLIFERA.

Wings extended; first joint of posterior tarsi large, compressed, square, or triangular, provided with a tuft of hair adapted for collecting pollen of flowers; jaws and lip long, narrow, produced into a proboscis; chin elongated, supported on a pedicle; labium mostly lanceolate or filiform, long and hairy.

TRIBE I. ANDRENETÆ.

In some species the intermediate division of the labrum widened into a heart-shape, and sometimes lanceolate, always shorter than the chin, nearly straight, or simply folded upwards; jaws and lip forming a proboscis bent downwards.
Andrena pilipes, pl. 29, f. 121.

TRIBE II. APIARIÆ.

Intermediate division of the labium filiform or setaceous, at least the length of the sheath, bent downwards; jaws and lip lengthened into a proboscis, folded downwards in repose; labial palpi compressed, filamentary scaly.
Apis centhuncularia, pl. 28, f. 122.

ORDER IX. LEPIDOPTERA.

Four membranaceous wings, covered with a farina composed of minute scales, and having a trunk spirally rolled up, inserted at the mouth.

FAMILY I. DIURNA.

Wings free in repose, perpendicular to the plane of position, and devoid of a scaly bristle at the base of the inferior wings; antennæ, in many, claviform, or terminating in a button, more or less conical or triangular, in others slender, and hooked at the termination.

TRIBE I. PAPILIONIDES.

Legs with a pair of spurs or spines; four wings perpendicularly elevated in repose; antennæ either claviform or nearly filiform, destitute of hooks, except in one genus, in which they are plumose and setaceous in one of the sexes.
Papilio Childreni, pl. 29, f. 123.

TRIBE II. HESPERIDES.

Two pair of spurs on the posterior legs; lower wings nearly horizontal in repose; antennæ terminated by a button or a club, in some with a terminal hook; in others filiform, with a slender extremity bent and pointed.
Hesperia malvæ, pl. 29, f. 124.

FAMILY II. CREPUSCULARIÆ.

With a stiff, horny bristle near the insertion of the lower wings, at their margin, entering a groove below the upper ones, keeping them horizontal in repose; antennæ claviform elongated, frequently pectinated or serrated. Caterpillars with sixteen large feet.

TRIBE I. HESPERIA—SPHINGES.

Antennæ simple, clavate, hooked at tip, and destitute of a tuft of scales.
Castnia acroeoides, pl. 29, f. 125.

TRIBE II. SPHINGIDES.

Antennæ with a scaly, tufted termination, in a prismatic club, thickening from their middle: lower palpi broad, scaly, third joint smaller, and usually indistinct.
Sphinx convolvuli, pl. 29, f. 126.

TRIBE III. ZYGÆNIDES.

Antennæ, for the most part, devoid of tufted scales at their points, fusiform, or ram's-horn-shaped; labial palpi slender, compressed, cylindrical, or conical, third joint very distinct.
Zygæna pulchella, pl. 29, f. 127*.

FAMILY III. NOCTURNA.

Wings horizontal or inclined in repose; antennæ setaceous.

TRIBE I. BOMBYCITES.

Antennæ of males pectinated or serrated; trunk very short, or nearly none; body woolly and thick in the females; wings frequently extended, and when inclined, lower ones margin the upper, or are turned up.
Bombyx pavonia, pl. 29, f. 128.

TRIBE II. NOCTUO-BOMBYCITES.

Spiral trunk very short, or none; some of the males have antennæ proceeding anteriorly with a double row of bristles; females in some, and both sexes in others, with a series of short rounded teeth.
Cossus Macmurtrei, pl. 29, f. 127.

TRIBE III. TINEITES.

Upper wings long and contracted, lower ones broad and plicated, resting horizontally on the body in some, on others hanging nearly vertically on the sides, and raised upwards behind; body cylindrical, or elongated; labial palpi, in some short, nearly cylindrical, in others thrown backwards in the form of horns; antennæ usually simple.
Tinea tapizana, pl. 29, f. 129.

TRIBE IV. NOCTUÆLITES.

Nocturnal, with entire wings, horizontally extended, or forming a triangle with the body; tarsi and labial palpi bent, compressed, clothed with scales, and terminating abruptly by a joint more slender and shorter than the preceding.
Noctua oculata, pl. 29, f. 130.

TRIBE V. TORTRICES.

Wings in repose, slightly sloped, or horizontal; body broad, short, somewhat triangular.
Herminia Sidonia, pl. 29, f. 131.

TRIBE VI. PHALÆNITES.

Body frequently slender; wings extended or in a flattened slope; trunk very minute, or none; antennæ pectinated in many males.
Phalæna machaonaria, pl. 29, f. 132.

TRIBE VII. CRAMBITES.

Wings, either vertical or in a flattened slope, upper ones long and narrow, under ones broad.
Crambus retusalis, pl. 29, f. 133.

TRIBE VIII. PTEROPHORITES.

Wings either in two, or all cleft; body slender, elongated; feet long; antennæ simple; trunk distinct; wings sometimes remote from the body, in others inclined and close.
Orneodes hexadactylus, pl. 29, f. 134.

ORDER X. STREPSIPTERA.

Wings two, naked and membranous, accompanied by two balancers, longitudinally folded, forming nearly the quadrant of a circle; metamorphosis incomplete.

This order consists but of two genera.
Stylops Childreni, pl. 29, f. 135.

ORDER XI. DIPTERA.

With two membranous extended wings, and a balancer under each in most species; six feet; provided with a sucker, composed of a variable number of scaly, setæform pieces, either inclosed in the upper furrow of a sheath, or inarticulated proboscis, terminated by two lips, or cased in one or two plates.

Section I.

Head large or of medium size, distinct from the thorax; tarsial hooks simple, or unidentated; sucker inclosed in a sheath.

FAMILY I. NEMOCERA.

Antennæ with six joints at least, but usually with fourteen to sixteen.

TRIBE I. CULICIDES.

Palpi produced, and very hairy, particularly in the males; antennæ filiform, length of head and thorax, fourteen plumose joints in the males; eyes lunate; trunk cylindrical, lengthened, and projecting, and tumid at the point, inclosing a sucker of six pieces.
Culex pipiens, pl. 29, f. 136.

TRIBE II. TIPULARIÆ.

Rostrum sometimes very short, terminated by two large labiform processes, sometimes in the form of a siphon, directed longitudinally under the body, sucker of two pieces; palpi slightly crinated, usually bent, very short and elevated.
Tipula oleracea, pl. 29, f. 137.

FAMILY II. TANYSTOMA.

Rostrum frequently lengthened, sometimes nearly concealed; sucker of six pieces.

TRIBE I. TABANII.

Terminal joint of antennæ without seta or style at its tip, with four or eight transverse rings; rostrum prolonged, in many species filiform and external; wings always distant.

Tabanus Africanus, pl. 29, f. 138.

TRIBE II. SICARII.

The greater part of the rostrum frequently concealed; with two terminal projecting lips; sucker of four pieces; last joint of antennæ destitute of style or seta, and consisting of three transverse divisions.

Cœnomyia pallida, pl. 29, f. 139.

TRIBE III. MYDASII.

Without exterior palpi; terminal joint of antennæ styliferous or clavate, divided transversely, with an umbilicus at the tip, in the form of an elongated cone, or subulate.

Mydas Lusitanicus, pl. 29, f. 140, *a* and *b*.

TRIBE IV. LEPTIDES.

With exterior palpi; antennæ very short, of equal thickness, granulated, or nearly moniliform, terminated by seta.

Leptis fasciata, pl. 29, f. 141.

TRIBE V. DOLICHOPODA.

Rostrum very short, with two large terminal labriform processes, with palpi placed on them, or produced with a short beak; last joint of antennæ flattened, and provided with a seta; wings resting on the body.

Porphyrops diaphanus, pl. 29, f. 142.

TRIBE VI. ASILICI.

Mouth bearded; terminal joint of antennæ elongated, filiform, or clavate, with a styliferous termination, or thick and stiff hair; body oblong; thorax compressed before.

Asilus crabroniformis, pl. 29, f. 143.

FAMILY VII. HYBOTINI.

Head globular, wholly occupied by the eyes in males; terminal joint of antennæ lenticular, with an elongated hair-shaped seta.

Ocydromya glabricola, pl. 29, f. 144.

TRIBE VIII. EMPIDES.

Rostrum produced, nearly cylindrical and perpendicular, inclosing a sucker; antennæ formed of two or three principal pieces, the last undivided; body elongated; balancers naked; head round; abdomen cylindrical or conical; feet long.

Empis pennipes, pl. 29, f. 145.

TRIBE IX. ANTHRACII.

Body not raised on the back, short, and broad; wings remote; head placed against the thorax, and on a level with it.

Anthrax marginicollis, pl. 29, f. 146.

TRIBE X. BOMBYLIARII.

Head inserted low; thorax elevated and gibbous; balancers naked; abdomen oblong or triangular; rostrum directed forwards; antennæ approximate at their base, terminated by a seta, without a style.

Bombylius major, pl. 29, f. 147.

TRIBE XI. VESICULOSA.

Head inclined, thorax elevated; balancers covered by a plate; abdomen inflated, vesicular; antennæ two-jointed, very small in some species, with a terminal seta; or sometimes three-jointed, last having no style or seta.

Henops marginatus, pl. 29, f. 148.

FAMILY III. NOTACANTHA.

Rostrum generally membranous, short, concealed, except the terminal lips; sucker of two pieces; in others long, syphon-shaped, and concealed by a produced beak, which supports the antennæ; terminal joint of antennæ, with many rings; wings resting on the body, and provided with a central radiated ariola.

TRIBE I. XYLOPHAGEI.

Terminal joint of antennæ divided into eight rings.

Beris violaceus, pl. 29, f. 149.

TRIBE II. STRATIOMYDES.

Terminal joint of antennæ with five or six rings, exclusive of the style.

Stratiomys, chamæleon, pl. 29, f. 150.

FAMILY IV. ATHERICERA.

Sucker consisting of two or four pieces, the two contiguous ones provided with palpi; retracted within the sucker into a furrow of the proboscis.

TRIBE I. SYRPHIÆ.

Antennæ of various lengths, some placed on a pedicle, their seta simple.

Syrphus obscurus, pl. 29, f. 151.

TRIBE II. CONOPSARIÆ.

Proboscis syphon-shaped, either conical, cylindrical, or setaceous.

Conops macrocephala, pl. 29, f. 152.

TRIBE III. ŒSTRIDES.

Buccal cavity bituberculate in some, in others a small cleft; proboscis exceedingly small where it exists; in some two palpi; antennæ very short, inserted in a cavity.

Œstrus Bovis, pl. 29, f. 153.

TRIBE IV. MUSCIDES.

Antennæ two or three-jointed, the latter prevailing, last joint depressed, with a simple or plumose seta on its back, near the base; proboscis membranous, bilobate, geniculate, withdrawn into a buccal cavity in repose; sucker with two setæ.

Musca Vomitoria, pl. 29, f. 154.

Section II.

Proboscis consisting of two setæ, emerging from the buccal cavity, covered by two plates or palpi, instead of a sheath.

FAMILY V. PUPIPARÆ.

TRIBE I. CORIACEÆ.

Many species have wings; head and eyes of ordinary form and size; with a square thorax.

Hippobosca equina, pl. 29, f. 155.

TRIBE II. PHTHYROMYIÆ.

Body apterous; head small, appearing like a capsular tubercle placed on the thorax, which is semicircular; eyes small, granulated.

Nycteribia vespertilionis.

DESCRIPTION OF EXTERNAL PARTS OF INSECTS.

PLATE XXVI.

THE HEAD AND ITS EXTERNAL ORGANS.

The HEAD furnishes the most distinctive characters of insects. It is exceedingly varied in its general form, as well as in its several parts. The most important of these are the *mouth*, *antennæ*, and *eyes*. The head of a Dipterous insect is represented, figure 22, with all its appendages; but the head, independently of these is confined within the limits of *a a*, f. 22, 25.

MOUTH. This organ is very complicated, and subject to great diversity of form and construction, admirably adapted to the nature of its food. It consists of six parts, the *labrum*, *mandibles*, *maxillæ*, *palpi*, *labium*, and *mentum*.

Labrum, or upper lip, figs. 22, 23, 25, *e*, *e*, *e*.
Mandibles, f. 25, *k*, *k*.
Maxillæ, f. 24, *i*.
Palpi, f. 22, 23, 24, 25. *b*, *b*, *b*, *b*, *b*, *b*.
Labial lobes, f. 22, 23, 25, *g*, *g*. *g*.
Mentum, f. 31, *a*.
Proboscis, f. 31, *b*.
Lingua or tongue, f. 31, *e*.

(Description of External Parts of Insects. Plate XXVI. Continued.)

ANTENNÆ. Horn-like processes consisting of several joints; considered by some naturalists as organs of touch, and by others, organs of hearing, f. 22, *f*, *d*.

Nasus or nose, f. 22, *f*.
Eyes, f. 22, *l*, *l*.
Neck, f. 22, *h*.
The Thorax and its several divisions; f. 26.
Collar, or prothoracic scutellum, f. 22, 26, *m*, *m*.
Præscutum, f. 26, *n*.
Scutum, *o*.
Scutellum, *p*.
Metathoracic Scutum, f. 26, *q*.

To the Thorax are attached the wings, *r*, *r*: the rudimental alulæ or winglets *w*: the base of the intermediate femur *t*: the balancers *u*: the base of the posterior femur *v*, and the legs.

Wing, f. 25, *w*.
Elytra, are membranous or horny substances which cover the wings of insects of the order Coleoptera, f. 25, *x*, *x*.
Upper or superior wing of a Lepidopterous insect, f. 27.
Anterior margin, or costal nerve, *a*.
Interior margin, *b*.
Exterior margin, *c*.
Post-costal nerve, *d*.
Anal nerve. *e*.
Compound ocellus, or the discoidal cell, *f*.
Dentate fascia, *g*.
Lower or inferior wing of a Lepidopterous insect, f. 28.
Anterior margin, *a*.
Exterior margin, *b*.
Interior margin, *c*.

THE ABDOMEN.

The abdomen is that part which is attached to the posterior extremity of the thorax, and consists of six segments or wings, to which there are never any legs attached, f. 29.

THE LEGS.

The whole insect tribe are provided with but six legs; they are composed of five parts, f. 30.
Coxa, or haunch, is the first joint, *a*.
Trochanter, or second joint, *b*.
Femur, or thigh, *c*.
Tibia, or shank, *d*.
Tarsus, *e*. This member consists of from three to five articulate parts, among Coleopterous insects, and most others. To the last of these articulations are attached the claws.

PLATE XXVI.—ARACHNIDES—MYRIAPODA.

Fig.
1 Scorpio Afer.
2 Thelyphonus Caudatus.
3 Mygale Cæmentaria.
4 No fig.
5 Scytodes thoracica.
6 Epeira diadema.
7 No fig.
8 Lycosa Tarantula.
9 No fig.
10 Pycnogonon Balænarum.

Fig.
11 Chelifer Cancroides.
12 Siro rubens.
13 Trombidium tinctorum.
14 Hydrachna geographica.
15 Argas reflexus.
16 Leptus Autumnalis.
17 Julus Subulosus.
18 Polyxenus lagurus.
19 Scutigera araneoides.
20 Lithobius forficatus.

Fig.
21 Scolopendra morsitans.
22
23
24
25
26
27
28
29
30
External parts of Insects, referred to at p. lii and liii of this index.

PLATES XXVIII. AND XXIX.—ENTOMOLOGY.

The numbers are continuous in Plates 28 and 29.

Fig.
1 Machilis polypoda.
2 Podura plumbea.
3 Ricinus corvicoracis.
4 Pediculus coturnicis.
5 Pulex irritans.
6 Cicendela octonata.
7 Brachinus Jurinæ.
8 Colymbetes marmoratus.
9 Cyrinus sulcatus.
10 Oxyporus rufus.
11 Pæderus ruficollis.
12 Lesteva dichroa.
13 Tachinus atricapillus.
14 Buprestis rufipes.
15 Elata areolus.
16 Rhipicera cyanea.
17 Lampyris Savignyi.
18 Malachius æneus.
19 Opilo mollis.
20 Anobium tesselatum.
21 No fig.
22 Hololepta glabra.
23 Necrophorus mallei.
24 No fig.
25 No fig.
26 Dermestes lardarius.
27 Byrrhus pilula.
28 Heterocerus marginatus.
29 Hydrophilus caraboides.
30 Sphœridium scarabœoides.
31 Oryctes Chevrolatii.
32 Lucanus cinnamoneus.
33 Pimelia vestita.
34 Blaps mortisaga.
35 Crypticus gibbulus.
36 Diaperis boleti.
37 Cossyphenes Hoffmanseggii.
38 Cnodalon nodosum.
39 Helops violaceus.
40 Cistela sulphurea.
41 No fig.
42 Œdemera podograria.
43 No fig.

Fig.
44 No fig.
45 Pyrochroa coccinea.
46 Mordella aculeata.
47 Notoxus monoceros.
48 Horia maculata.
49 Cantharis vesicatoria.
50 Bruchus pisi.
51 Anthribus laterostris.
52 Brentus anchorago.
53 Curculio imperialis.
54 Scolytus ulmi.
55 Bostrichus capucinus.
56 Paussus microcephalus.
57 Dasycerus sulcatus.
58 Cucujus Dejeanii.
59 Prionis coriarius.
60 Cerambyx hirtipes.
61 Necydalis major.
62 Saperda albicans.
63 Leptura annulata.
64 Sagra Cayanea.
65 Crioceris merdigera
66 Cassida viridis.
67 Chlamys cuprea.
68 No fig.
69 Erotylus giganteus.
70 Cocinella septempunctata.
71 Eumorphus tetraspilotus.
72 Chennium bituberculatum.
73 Forficula spongiphora.
74 Blatta maculata.
75 Mantis religiosa.
76 Phyllium psama.
77 Gryllus trifasciatus.
78 Acridium ornatum.
79 Scutellera vasalis.
80 Cimex lectularius.
81 Reduvius raptatorius.
82 Hydrometra linearis.
83 Ledra aurata.
84 Belostoma marginata.
85 Noctonecta glauca.
86 Cicada flavopunctata.

Fig.
87 Fulgora punctata.
88 Darnis camelus.
89 No fig.
90 Livia juncorum.
91 Thrips physapus.
92 and 92 *a* Aphis rosea.
93 Coccus cacti.
94 Libellula varia.
95 Ephemera bioculata.
96 Panorpa rufa.
97 Ascalaphus barbarus.
98 Hemerobius longicornis.
99 No fig.
100 No fig.
101 Perga scutellata.
102 Termex columba.
103 Pelecinus policerator.
104 Ichneumon unifasciatorius.
105 No fig.
106 Chalcis clavipes.
107 Chrysis ignita.
108 No fig.
109 Formica Herculanea.
110 Mutilla Klugii.
111 Scolia tricincta.
112 No fig.
113 Pompilus viaticus.
114 Podium nigripes.
115 Bembex rostrata.
116 No fig.
117 No fig.
118 Crabro cribrarius
119 Synagris cornuta
120 Masaris apiformis.
121 Andrena pilipes.
122 Apis centhuncularia.
123 Papilio childreni.
124 Hesperia malvæ.
125 Castnia acrocoides.
126 Sphinx convolvuli.
127 Cossus Macmurtrei.
127* Lygæna pulchella.
128 Bombyx pavonia.

(Plates XXVIII. and XXIX. Entomology. Continued.)

Fig.
129 Tinea tapizana.
130 Noctua oculata.
131 Herminia Sidonia.
132 Phalæna machaonaria.
133 Crambus retusalis.
134 Orneodes hexadactylus.
135 Stylops Childreni.
136 Culex pipicus.
137 Tipula oleracea.

Fig.
138 Tabanus Africanus.
139 Cœnomyia pallida.
140 *a* and *b*. Mydas Lusitanicus.
141 Leptis fasciata.
142 Porphyrops diaphanus.
143 Asilus crabroniformis.
144 Ocydromya glabricola.
145 Empis pennipes.
146 Anthrax marginicollis.

Fig.
147 Bombylius major.
148 Henops marginatus.
149 Beris violaceus.
150 Stratiomys chamæleon.
151 Syrphus obscurus.
152 Conops macrocephala.
153 Œstrus Bovis.
154 Musca vomitaria.
155 Hippobosca equina.

ECHINODERMATA, ENTOZOA, INFUSORIA, MOLLUSCA, ACALEPHA, ANNELIDA, AND PHOSPHORESCENT ANIMALS.—PLATE XXVII.

ECHINODERMATA.

The tenth class of invertebrate animals, or such as are devoid of a backbone. These animals have a suborbicular body, protected by a coriaceous or crustaceous covering. They are radiated, and destitute of a head and eyes, and have not articulated limbs; the mouth is placed beneath, and is either simple or multiform; the organs of digestion are compound; and the covering is provided with exterior tubes or pores for respiration.

The older naturalists arranged this class of animals among the testaceous Mollusca, others placed them in the class Zoophytes; and in more modern times they occupied a situation among the crustaceous animals.

The strict attention which has recently been paid to comparative anatomy, has enabled physiologists to form more distinct and decided zoological arrangements, founded principally on their internal structure; in consequence of which this group of animals has been formed into a separate class by Lamarck, who placed them as the first of the great division of radiated animals.

Besides the external distinctions which we have above given, the internal cavity is furnished with distinct viscera, and a sort of vascular system maintains a communication through the different parts of the intestine, and with the respiratory organs. These consist of pores or orifices, or tubes placed on the exterior covering for the passage of water. Their nervous system is but indistinctly traced, and they have but extremely imperfect organs of motion.

The whole of the animals constituting this class inhabit the ocean, and, like many other of the lower animals, have the power of regenerating parts of their bodies which have either been injured or broken off.

Lamarck divides the Echinodermata into three sections, under the names Fistulides, Echinides, and Stellerides; and we have followed Mr. Millar in adding a fourth section, which he names Crinoidæ, formed from the Encrinites.

Section I.—FISTULIDES OR HOLOTHURIÆ.

Body elongated, cylindrical, soft and very retractile; covered by a soft mobile and irritable skin.

These animals respire through the medium of water by pores or tubes, which are retractile, and inhabit the sea shores.

Fistularia digitata, pl. 27, f. 3. Body free, soft and cylindrical; covered with a very rough and tubercular coriaceous skin; mostly terminal, surrounded with dilated tentacula at the summit, the flattened part divided or dentated; and vent at the posterior extremity.

Two other species, the *Holothuria inhærens* and the *Holothuria squamata*, are represented in figs. 12 and 26 of the above plate.

Under the Fistulidæ Lamarck included the Actiniæ, though Cuvier has placed these among the Polypi.

Actinia verrucosa, pl. 27, f. 11. With a cylindrical, fleshy, simple and very contractile body, fixed by its base, but having the power of removing itself; mouth terminal, and having one or many rows of radiated tentacula, which they can contract entirely. They have the appearance of a flower in blossom; hence their familiar name of sea-anemone.

Section II.—ECHINIDES.

With a solid immovable crust or shell; body subglobular or depressed, destitute of radiating contractile lobes; mouth and anal opening distinct: tubercles on the exterior surface; the shell immovable, but the spines susceptible of motion.

The differences of the animals of this section require to be formed into two sub-sections. First, those having the anal opening above the margin and dorsal, and vertical, and with a regular shell. The genera are Cidarites, and

Echinus esculentus, pl. 27. f. 1. With a regular, gibbous, orbicular, globular, or oval body; shell solid, crustaceous, and provided externally with imperforate tubercles, upon which are articulated movable spines; compartments five, each margined by two multiporous divergent bands, extending in rays from the summit to the mouth, which is inferior, central, and armed with five bony enamelled pieces; anal opening above.

This sub-section is again subdivided into animals with a dorsal anal opening, but approaching the margin. The genera are Nucleolites and Cassidulus.

The second sub-section consists of animals whose anal opening is under the margin of the disk, or on the margin. This is again subdivided into, first, those with the mouth beneath, not central, but approaching the margin. The genera are Ananchytes, and

Spatangus purpureus, pl. 27, f. 5. Having an oval or cordiform and subgibbous body, covered with very small spines; from four to five unequal compartments; mouth labiated transverse, approaching the margin; and opening lateral, placed opposite the mouth.

The animals of this section are known by the familiar names of sea-urchins, sea-eggs, &c.

Section III.—STELLERIDES.

Having a coriaceous, but not irritable skin, which is movable in certain points; body short, depressed, broader than long, provided with marginal lobes, more or less numerous, radiating and movable; no anal opening.

The genera are Ophiura, Euryale, Comatula, and

Asterias rubens, pl. 27, f. 2. With a suborbicular depressed body, divided in its circumference into angles, rays, or lobes, disposed in a stellated form; under surface of the rays provided with a longitudinal furrow, bordered on each side by movable spines, and orifices for the tubular or retractile feet; mouth central and placed beneath, at the union of the furrows.

The animals of this genus are known by the name of star-fish, and are common on most coasts. They feed on marine worms and the smaller crustacea.

Section IV.—CRINOIDÆ.

The animals of this section have been divided into four sub-sections by Mr Millar.

1. Plates of the body or pelvis resting on the last columnar joint, and forming the cup containing the viscera, articulated with each other by lip-like trans-

verse processes; having a minute perforation. The genera are Apiocrinites, and

Pentacrinus Europæus. The pelvis consisting of five plates, supporting five costals; column not enlarging at the summit; fingers formed of a single series of joints; column pentagonal; the articulating surface of the columnar joints petal-shaped.

This animal has been found alive at the Cove of Cork.

2. Plates of the body articulating imperfectly with each other by transverse processes, having a minute central perforation. But one genus, Poteriocrinites.

3. Having the plates of the body adhering by sutures lined by a muscular ligament. The genera are Lego-thocrinites, Actinocrinites, Rhodocrinites, and Platycrinites.

4. The plates of the body anchylosing with the last columnar joint.

These different genera have all been found in a fossil state in the limestone in different parts of Great Britain, and are known by the names of Lily Encrinites, St. Cuthbert's beads, &c.

ENTOZOA.

This is the *eleventh* class of animals, according to the descending scale. It comprehends all those creatures known by the name of intestinal worms, remarkable for inhabiting and propagating within the bodies of other animals. Almost every animal is subject to be infested with worms. These are found in the alimentary canal, and its communicating vessels, and also in the cellular substance, the liver, and the brain.

The intestinal worms are destitute of all the organs of respiration, nor have any circulating vessels, or a nervous system, been detected in them. Besides those which inhabit animal bodies, there are others which possess similar characters; hence naturalists have placed them in this class.

The circumstance of some of the Entozoa living in the liver and brain, and other parts of the system, which are inaccessible, by direct means, to the alimentary canal, has excited surprise; many have accounted for their existence upon the theory of spontaneous vitality. But when we find that almost the whole intestinal worms embrace two sexes, we think it a pretty conclusive proof that these animals are produced by the ordinary means.

Although these animals must have been known to mankind from the earliest ages, yet their history has been but little investigated till lately. Two distinguished living individuals, Professors Bremser and Rudolphi, have devoted their lives to making collections, and studying the habits and cure of this interesting though obscure race of beings; and Captain Thomas Brown, of Edinburgh, some years ago, added a new species to the list of those inhabiting the human frame.

In treating of these animals we follow the arrangement of Latreille, as given in his Familles du Regne Animal. The characters of the Class are, body soft, elongated, almost all naked; destitute of head, eyes, and feet; as also of tentacula, and the organs of respiration: in some species the intestinal canal is hardly perceptible.

ORDER I. ELMINTHOGAMA.

Consists of worms which locate themselves on the exerior of aquatic animals, or in the internal parts of others, having a mouth, vent, and separate sexual organs; two nerve-like filaments in some species, taking their rise near the opening of the œsophagus.

Family I. Entomoida.

Inhabiting the exterior of aquatic animals, with feet-like appendages; the females, with two ovaries at the termination of their bodies.

Tribe I. Thoracica.

Body subdivided, the one part representing the head and thorax, and the other the abdomen.

Tribe II. Capitata.

Anterior extremity having the appearance of a head.

Tribe III. Anguilliformia.

With an elongated linear body, having fin-like processes at the posterior extremity; anterior end with a sort of small denticula.

Tribe IV. Rhizoda.

With an elongated slender body, having terminal processes.

Tribe V. Acola.

Destitute of external processes, the ovaries only projecting.

Family II. Lumbricoida.

Worms which inhabit the interior of animals, and destitute of either feet-like processes or antennæ.

Tribe I. Anodonta.

Body usually filiform, with an orbicular mouth, without hooks or spines, but having lips, papillæ, or a small naked tube in the shape of a proboscis.

Genus Ascaris. Body long and round, elastic and attenuated at both ends; head provided with three tubercles; the posterior extremity obtuse or subulated. *Ascaris lumbricoides*, or large round worm, pl. 27, f. 57. Inhabits the large and small intestines in man.

Genus Oxyurus. Cervical extremity minute, undulated, and the posterior extremity spiral; skin at the sides of the body finely crenated. *Oxyurus vermicularia*, pl. 27, f. 59 male, f. 58 female. These inhabit the intestines of children, even in new-born infants, especially in the rectum. *Oxyurus angulata*, pl. 27, f. 62 male, f. 63 female; inhabiting the human intestines. *Filaria medinensis*, pl. 27, f. 55. *Trichocephalus dispar*, pl. 27, f. 60 male, f. 61 female. *Hamularia subcompressa*, pl. 27, f. 66. *Strongylus gigas*, pl. 27, f. 65.

Tribe II. Echinostoma.

Mouth provided with teeth or hooks, and the body seldom filiform.

ORDER II. ELMINTHAPROCTA.

Worms which inhabit the interior of the bodies of animals; organs of generation united in each individual; destitute of a floating alimentary sac, but provided with a simple cavity in the interior; and nearly or totally devoid of nerves.

Family I. Hirudiformia.

Provided with distinct sexual organs; body enveloped in a cyst; soft, generally depressed, somewhat resembling a leech in form, provided with suckers, of which one or more answer the purpose of a mouth.

Tribe I. Oligopora.

Having one or two suckers.

Tribe II. Polypora.

Having at least three suckers.

Family II. Cestoidea.

Having sexual organs, or at least distinct ovaries; body long and frequently articulated, but not enveloped in a cyst; mouth consisting of four probosciform processes, or osculi, surrounding a trunk-shaped mammilla, some provided with small spines, and others with hooks.

TRIBE I. ANTHOSTOMA.

Having four trunks or projecting and retractile suckers.

TRIBE II. STEPHANOSTOMA.

Having but one proboscis, and the lateral osculi slightly or not at all projecting.

SUBDIVISION I.

Of this order the most interesting to mankind, must be those which are most common in the human body; to which we shall confine our descriptions.

Genus Bothriocephalus. Body greatly elongated and much depressed, consisting of a series of many articulations; head subtriagonal; tail often bifurcated; with oscula or suckers placed in the centre of the articulations on both sides. *Bothriocephalus latus*, or *Broad tape-worm*, pl. 27, f. 56.

SUBDIVISION II.

Genus Tænia. Body elongated, depressed, and consisting of numerous articulations, each of which is provided with an osculum on both sides, placed in the centre of the edges; and the head provided with four sucking oscula. Two species of the *Tænia* or tape-worm are represented in figs. 67 and 68 of the above plate.

FAMILY III. CYSTICA.

Animals enveloped in a cyst, sometimes solitary, at others congregating, often in many groups; body either wholly vascular, or behind only; destitute of ovaries.

TRIBE I. MONOBIA.

Animals each inclosed in a separate cyst.

Cysticercus cellulosæ, pl. 27, f. 64. Inhabits the cellular tissue, &c.

TRIBE II. SYNBIA.

Many animals inclosed in a single cyst, and these often in separate groups, and which they can leave or enter at will.

INFUSORIA.

By the term *Infusoria* is understood all those minute animals, many of them invisible to the naked eye, which abound in the infusions of animal and vegetable substances. They form the fifth class of the Radiata, or fourth division of the animal kingdom of Cuvier, and are divided by that naturalist into two orders, *Rotifera* and *Homogenea*. Several hypotheses have been proposed to account for their existence; and probably that one is the most rational, which supposes minute ova to be floating continually in our atmosphere, and that these falling into a suitable nidus, such as an infusion of animal and vegetable matter, arrive at maturity, and are developed in the animalcular forms so familiar to every microscopic observer.

The history of *Infusoria* is altogether dependent on the microscope, and till lately the powers of that instrument were not sufficiently delicate to exhibit more, at least in many cases, than the actual vitality of these tiny creatures. Within the last twenty years, however, optical science has made great advances in the improvement of the microscope; and one result has been the discovery of interesting facts regarding the Infusoria, which bring them into closer analogy with higher animals, and cause them to occupy a more important place in zoology than had been previously assigned them.

Relying on very imperfect optical aids, Buffon and others strangely concluded that Infusoria, and animalcula generally were not really living creatures, but "active organic particles," a something not actually vital, but peculiarly fitted to combine into an animated existence. We do not profess to understand what these philosophers meant; probably they had not themselves any very clear notions of their meaning. It was also a prevailing opinion, till of late, that Infusoria were merely gelatine masses, nourished by *absorption*, and altogether unprovided with the organs which exist in larger animals. But by long and patient examination, with instruments of accurate and highly magnifying powers, Ehrenberg discovered in nearly every species of animacula, sacs or stomachs suitable for the *digestion* of food; mouths fringed with cilia (very delicate hairs) singularly adapted to assist these minute creatures in *obtaining* food; and even eyes, in some of the species, of very perfect structure. These facts, resting as they do on sufficient authority, and admitting of easy confirmation with a microscope of suitable power, have excited an interest regarding the Infusoria little less remarkable than the extreme indifference which the elder naturalists manifested towards them. An ingenious expedient adopted by Ehrenberg to render the more diaphanous animalcula distinctly visible, offers sufficient proof on these points: that these creatures feed by a mouth like higher animals, and receive their food into a stomach where it is digested. This naturalist, being engaged in an examination of animalcula perfectly colourless, and so transparent that their bodies scarcely intercepted the light sufficiently to render them visible, conceived that if they would feed on any coloured matter, the reception of this matter would give some degree of opacity to their bodies, and render his research less difficult. It occurred to him to introduce a very small quantity of carmine into the water containing them, and on this he observed they readily fed, whilst the coloured matter was seen to pass from the mouth into the sacs or stomachs, and to undergo changes, the supposed effect of digestion, as it progressed from one sac to another.

We deem it unnecessary to extend these observations to greater length, as a very copious account of the Infusoria will be found in vol. ii. p. 623—638; to which the reader is referred for all particulars regarding the species figured in plates 27 and 35.

MOLLUSCA.

The following are some specimens of Molluscous animals, not included in Plates XXIV. and XXXI., and of which a particular description is not given in the text. See p. 578–584, vol. ii.

ORDER CEPHALOPODA.

Loligo vulgaris. Medium cuttle-fish, pl. 27, f. 6. With a fleshy depressed body contained in a bag, which in most species is obtuse behind and margined on both sides through their whole length by a narrow fin; within the body, and near the back is included a free, calcareous, spongy, and opaque bone; mouth terminal, surrounded with ten arms provided with cups, of which two are longer than the rest, and placed on peduncles.

ORDER GASTEROPODA.

Limax ater. Pl. 27, f. 25. Body black, rounded above and rugous towards the tail.

Onhidium Typha. Pl. 27, f. 7. Body oblong, and margined on both sides by the mantle; tentacula two, cylindrical and retractile; mouth without jaws, and with two annular appendages.

Laphysia deplians. Pl. 27, f. 8. Body oblong convex, with a large mantle bordering it on each side, which covers the back while in a state of repose; head with a neck attached; and with four tentacula disposed in pairs; branchial operculum inclosing a shell; anal opening placed on the back, near the branchiæ.

Doris Argus. Pl. 27, f. 9. The body oblong, plain, convex, or subprismatic, bordered all around by a membrane extending to each side of the head; mouth placed anteriorly and below; four tentacula, two of which are situate in a hollow on the body, and the two others near the mouth; anal opening near the base of the back, surrounded by projecting, laciniated, and fringed branchiæ; generative aperture on the right side. See the Note on Conchology, p. 350-358, vol. ii.

ACALEPHA.

Acalepha are marine animals, with a gelatinous body, circular and radiated in their structure, with a soft, transparent skin, susceptible of contraction and dilatation. They belong to the great division Radiata of the animal kingdom. From the stinging property possessed by some species of Acalepha the older naturalists described them as *urticæ marinæ*, sea-nettles;—a term of similar import to the name Acalepha (ακαλήφη, a nettle), first applied to these animals by Aristotle, and retained for the whole class by Cuvier, although many of the species are destitute of the urticating faculty. Linnæus gave them the name of Medusæ. On the sea-shore they are popularly known as stang-fish and stingers; while the flabby and seemingly shapeless appearance of the bodies, when stranded on the beach, has acquired for them the names of jelly-fish and sea-blubber. They exhibit, on a superficial examination, few traces of structure; but a careful study of their organization has revealed a complicated system elaborated out of the most simple elements. The bodies of these animals may be described as consisting of a quantity of sea-water organized into living tissues, which, when exposed on the shore, lose their fluids by evaporation, so that a jelly-fish weighing when alive twenty or thirty pounds, is diminished to the weight of scarcely as many grains. The sea-water is deposited in cells so attenuated and filmy as to become almost imperceptible; yet this simple cellular structure is made subservient to functions of a remarkable description. The acalephs, or medusæ, are all free and locomotive animals, of active habits, graceful motions, and not unfrequently of variegated colours. Many of the more minute species are phosphorescent. The principal parts of the structure are, first, a disk, forming the upper and expanded portion, generally hemispherical, but sometimes cylindrical and globular, the margin of the disk being provided with numerous tentacles, organs of prehension, and, perhaps, also of touch; and, secondly, a peduncle or proboscis-like body suspended from the centre of the disk, of variable shape and size, containing the stomach, and, in some genera, the ovaries. The outline of a hemispherical medusa, when afloat with its dependent peduncle and expanded disk, bears a resemblance to a mushroom with its stem, or an umbrella with its handle. The peduncle, however, is sometimes scarcely protuded below the level of the disk; it usually terminates in four spreading triangular lips, which are frequently fringed and frilled in a very elegant manner. The centre of these lips is the mouth, which leads into the upper cavity or stomach, excavated in the lower portion of the disk. From this cavity numerous slender vessels radiate to the circumference of the disk, conveying the nutrient fluid. The tentacles are organs of extreme sensibility, having great power of contraction, and are studded with capsules inclosing poison-threads, employed in stunning the prey seized by the tentacles, which is then passed into the mouth and swallowed. The great tawny species, *cyanea capillata*, with long trailing tentacles, which sting with equal fierceness whether they are attached to the body, or cast loose from it as the animal careers through the water, is the most familiar of the stinging medusæ in our seas. But the far greater number of species drifted upon the shore, or seen floating in shoals in still water, are either destitute of the urticating faculty, or it is so feebly developed as to render them quite inoffensive when handled. Around the margin of the disk are disposed the organs of sense. In a group named "Naked-eyed Medusæ," small spots or protuberances appear at the base of the tentacles, which are believed to be rudimentary eyes. In another group, named "Covered-eyed," the organ assumes a more definite and complex structure, consisting of minute columns of six-sided prisms of a transparent substance, and enveloped by folds of membranes. The former group also possess small marginal globules, supposed to be vibrating bodies, serving as a rudimentary organ of hearing. The common forms of medusæ, including most of the representatives of the class on the British shores, swim through the water by flapping their disks in measured pulsations, the body being inclined obliquely in the direction in which the animal is moving. This numerous group is named Pulmograde, from the lung-like motions by which they are propelled. Another group is named Ciliograde, from the locomotion of the animal being caused by the action of vibratile cilia or hairs, arranged like lines of paddles on bands stretching longitudinally along the body, resembling the meridian lines on a globe. The Beroë and Cydippe afford interesting examples of the creatures belonging to this group. When placed in a glass of sea-water, the Globe Beroë (*cydippe pileus*) resembles the purest ice. The body is of a globular form, about the size of a nutmeg. The paddles, extending along the meridian lines, are seen to be in constant motion, propelling the animal through the water with a swift and graceful motion, and emitting by their action brilliant flashes of phosphorescent light. In addition to its paddles, the Beroë throws out two long slender fishing lines, resembling the tendrils of plants, by which it seizes its prey, or moors itself to the surface of a solid body, and rides securely at anchor when it is disposed to be at rest. A third group (the Physograde) is represented by the Portuguese man-of-war (*Physalia*), the body being floated by large air-cells, and driven along the surface of the sea by the winds. Most of the smaller medusæ are creatures of exquisite delicacy and beauty. Their crystalline transparency, lively tints, measured movements, and symmetrical structure, combine to render them attractive objects of observation. Sars and other naturalists have established the fact, that the pulmograde medusa, in attaining to its mature condition, passes through a series of remarkable changes, appearing first in the state of a minute, ciliated ovum, moving about in quest of a suitable place for its subsequent growth; then settling down as a fixed polype, throwing off new individuals by germination or budding; and finally expanding into the form of the free-swimming medusa. "Hence," says Professor Owen, "a medusa may actually be generated three successive times, and by as many distinct modes of generation—by fertile ova, by germination, and by spontaneous fission—before attaining its mature condition." Figs. 10 and 20, plate 27 (*medusa campanula* and *M. pellucens*) may be referred to, as illustrating the general appearance of the pulmograde animals; along with these, figs. 16 and 17, in the same plate (*medusa lucida* and *M. scintillans*), represent some of the species contributing to the phosphorescence of the sea.

ANNELIDA OR ANNELIDES.

See p. 585 of this vol., where this class of animals and the specimens figured in plate 27, are described.

PHOSPHORESCENT ANIMALS.

Various marine animals are remarkable for the property of phosphorescence; and to them is now fairly attributed the once mysterious phosphorescence of the ocean. This phenomenon is occasionally observable everywhere at sea; but it is in warmer regions and more southern latitudes, that it attains its greatest degree of brilliancy and beauty. In these parts it has been thus described by a scientific observer:—"At one time, the evening serene and delightful, a pleasant breeze just filling the sails, and the bow of the vessel throwing the water to each side, as it gracefully parts the yielding waves, all around the ship, far as the eye can reach, may be seen innumerable bright spots of light rising to the surface, and again disappearing, like a host of small stars dancing and sparkling on the bosom of the sea. At another time, the night dark and lowering, a fresh breeze urging the ship rapidly onwards through her pathless track, upon looking over the stern, in addition to the smaller specks just now mentioned, large globes of living fire may be seen wheeling and dancing in the smooth water in the wake of the rudder; now, at a great depth shining through the water, then rising rapidly to the surface, they may be seen, as they reach the top of the wave, flashing a bright spark of light, sufficient almost to dazzle the eyes of the beholder; and now, again, they may be traced floating majestically along, till they gradually disappear in the darkness of the water in the distance. At other times, again, when light rain is falling, or perhaps previously to the rain coming on, when a light nimbose cloud is overspreading the sky, upon the water being agitated by the ship passing through it, or curled up by a rope towing overboard in a bight, a beautiful, general luminousness is diffused all around, bright enough to illuminate the whole ship's side, and the lower large sails which may be set at the time; and it is no unusual occurrence to have this appearance so bright, that a person with little difficulty, and near the surface of the water, might be enabled to read." That all this light is afforded by little animalcules, there cannot be the smallest room for doubt; for they have been caught in the very act of giving out the luminous appearance, and in vast numbers; and in every instance where the water has been properly examined when luminous, they have been seen in great quantities; while, on the other hand, when the water has not been luminous, they have not been visible. They have been described and figured by naturalists, who have studied them by the aid of powerful microscopes; and they are found to belong to the mollusca, the vermes, the crustacea, and the zoophytes. Light is also emitted from certain land insects, as from the lightning-bug and the glow-worm. A kind of phosphorescence, still different, is that observed in decomposing animal and vegetable matter. It appears during the putrefaction of fishes especially, but has been observed also from the flesh of quadrupeds. Our woods during autumn frequently exhibit a high degree of luminousness in light rotten wood. The first animal possessing the property of phosphorescence, which attracted the attention of naturalists, was the *pholas dactylus*, a species of conchiferous mollusc, protected by a testaceous shell. This quality in the pholas was first observed by Pliny, and has since been confirmed by Reaumur. Pliny says that the whole substance of the animal is charged with a fluid which has the property of emitting a phosphorescent light; and that it will illuminate any substance which it touches. This is the only testaceous mollusca which has the property of evolving a phosphorescent light. Dr. Priestley says, "This fish illuminates the mouth of the person who eats it: and it is remarkable, that, contrary to the nature of other fish, which give light when they tend to putrescence, this is more luminous the fresher it is; when dried, its light will revive on being moistened either with salt water or fresh; brandy however immediately extinguishes it." We have given representations of a few luminous animals in plate 27.

There are three species of beetle, of the genus Elater, which have the property of emitting light. These are the *E. noctilucus*, *E. phosphoreus*, and *E. ignitus*.

The great fire-fly (*Elater noctilucus*) fig. 21, is an inhabitant of the savannas of most of the warmer parts of America, where they are to be seen in great abundance, and also about the woods of several of the West India islands. They are extremely luminous in the dark, the light proceeding chiefly from four parts; namely, from two glandular spots behind the eyes, and one under each wing. But they have the property of interrupting this light at pleasure, when these glandular spots become perfectly opaque. When the rings of the abdomen are forced a little asunder, the same luminous appearance will be seen to issue indiscriminately from every part of their interior.

Fig. 21 exhibits the insect with the shell of the corcelet removed on one side, so as to uncover the light emitting organ.

Fig. 22 is a magnified representation of the luminous apparatus.

The common glow-worm (*Lampyris noctiluca*), fig. 34. During the summer season, these insects are observed after sunset, in meadows, by road sides, and near bushes. It is in the nights of the month of June that they are most frequently to be met with. In the daytime they conceal themselves amongst leaves of plants. Each sex is luminous, but in the male the light is less brilliant, and confined to four points, two of which are situated on each side of the two last rings of the abdomen. They always become much more lucid when they put themselves in motion. This would seem to indicate that their light is owing to their respiration; in which process, it is probable, phosphoric acid is produced by the combination of oxygen gas with some part of the blood, and that a light is given out through their transparent bodies by this slow internal combustion. By contracting themselves the insects have a power of entirely withdrawing it: when they are at rest, very little light is to be seen. Mr. Templer, who made many observations on glow-worms, says, he never saw them exhibit their light at all, without some sensible motion, either in their body or legs: and he fancied that he sensibly felt heat when the light was most brilliant. Dumeril, in speaking of the glow-worm, says, "This phosphorescent light appears to be intended by nature as the lamp of love—the pharos—the telegraph of the night, which scintillates, and marks, in the silence of darkness, the spot appointed for the lover's rendezvous." The same opinion is entertained by Kirby and Spence, see note to p. 548, ii.

Fig. 34 is the common glow-worm (*Lampyris noctiluca*). Fig. 24 represents one of the sacs of the glow-worm extracted, and very greatly magnified, in order to exhibit its construction, as described by Macartney.

Fig. 42 is a greatly magnified view of the inferior surface of the abdomen of the *lampyris lucida*, after the integuments have been removed.

The great lantern-fly (*Fulgora lanternaria*). This is the most vivid of all the luminous insects. It affords a light so great, that travellers walking by night are said to be enabled to pursue their journey with sufficient certainty, if they tie one or two of them to a stick, and carry this before them in the manner of a torch. It is common in many parts of South America, and is described by Madame Merian in her superb work on the insects of Surinam. She gives the following entertaining account of the alarm into which she was thrown by the phosphorescent flashing which proceeded from them in the dark before she had been apprised of their shining nature. The light emitted by this fly proceeds entirely from the hollow part of the head, which has been denominated the lantern.

"The Indians," says Madame Merian, "once brought me a number of lantern-flies, before I was aware that they shone by night, which I shut up in a large wooden box. In the night they made such a noise, that I awoke in a fright, and ordered a light to be brought, not being able to guess from whence the noise proceeded. As soon as I found that it came from the box, I opened it, but was still more alarmed, and let it fall to the ground in my fright, at seeing a flame of fire come out of it; and as many animals as came out, so many different flames appeared. When I found this to be the case, I recovered from my alarm, and again collected the insects, much admiring their splendid appearance." The light, she adds, of one of these insects is so bright, that a person may see to read a newspaper by it.

We have given a representation of the punctated lantern-fly (*fulgora punctata*) pl. 28, fig. 87.

There is an insect of the Myriopodous order, the electric centipede (*scolopendra electrica*), a native of Britain, which has the property of emitting a phosphorescent light in the dark. The insect is extremely plentiful, but it seldom leaves its hole in the ground during night. When it crawls about at night, it leaves a track of phosphorescent light, which may be lifted.

Dr. Afzelius discovered that the *pausus spherocerus*, an insect of the coleopterous order, yields light. One evening, on going to look at his insects, he happened to stand between the candle and the box, so that his body cast a shadow upon the insects; he was much astonished to find that the globes of the antennæ shone like two lanterns, emitting a pale, phosphorescent light. During the course of that night he examined the animal several times, when it always presented the same appearance. He was, however, prevented making experiments on it, as it died before morning, and he never could find another living specimen.

Fig. 33 is the night-shining nereis (*N. noctiluca*), greatly magnified. This animal was discovered by Vianelli. Its natural size is only a quarter of an inch. It is also certain that it yields a shining light. Vianelli noticed that there was light emitted from it at all seasons, but that it was stronger and more frequently to be seen in summer. He also observed that when the wind was about to change from south-east into the east, the intensity of the light was increased, and in the dark winter nights which succeeded a warm sun, the luminous appearance was as strong as in summer. Bondaroy says this species increases, diminishes, or extinguishes its light at pleasure, and that it commonly issues from the posterior part of the body; but when fully illuminated, the head only is opaque. The light emitted by it is of a bluish colour.

These minute creatures inhabit every sea, and are one of the causes of the luminosity of the water in the night. They are found on all kinds of marine plants; but often leave them, and swim on the surface of the water. They are frequent at every season of the year, but particularly in summer, before stormy weather, when they become more agitated and more luminous than at other times. So small are they, that myriads of them may be contained in a small cup of sea-water. Innumerable quantities of these animals lodge in the cavities of the scales of fishes; and to them, probably, many fishes are indebted for their luminous quality. "I have observed with great attention," says Barbut, "a fish just caught out of the sea, whose body was almost covered with them, and have examined them in the dark. They twist and curl themselves with amazing agility; but soon retire out of our contracted vision, probably on account of their glittering numbers dazzling the eye, and their extreme minuteness eluding our researches." It is to be observed that, when the unctuous moisture which covers the scales of fishes is exhausted by the air, these animals are not to be seen; nor are the fishes then noctilucous, that matter being, perhaps, their nourishment when living, as they themselves afford food to many marine animals.

The appearance of the nereides is particularly brilliant when the wind is in the east and south-east points; and in winter nights preceding a warm day. If water containing these animals be kept warm, they will retain their luminous appearance two whole days after they are dead; but in cold weather they lose it in the course of seven or eight hours. Motion and warmth, which increase their vivacity and strength, increase also their luminous properties.

Fig. 48 is the *nereis phosphoranus*, a luminous mollusca, which inhabits the African and Indian seas.

Fig. 19 represents the animalcule discovered by Forster, greatly magnified.

Fig. 18 is the *beroe fulgens*, size of life. This animal was discovered by Macartney, and is here represented in the elongated form which it assumes while in the act of swimming; on the posterior part are seen the ciliated ribs, which constitute its instruments of locomotion.

Fig. 27 is the *cancer fulgens*, represented in the natural size; it was discovered by Sir Joseph Banks, in his voyage with Captain Cook, in the passage from Madeira to Rio de Janeiro; he noticed that its whole body was illuminated, and emitted very vivid flashes of light.

Fig. 51 is the *simulus noctilucus*, greatly magnified; which was discovered by Captain Horsburg.

Fig. 32 is a crustaceous animal discovered by Riville, showing the transparent shell through which the internal parts of the animal are visible: the horseshoe-shaped appearance shows the sac containing the intestines; in front are seen the four-jointed setaceous antennæ; and on the right side are exhibited the feet armed with hooks; lower down is the larger hind foot; the small round specks represent the ova, which were mistaken by Riville for globules containing an oily fluid.

Fig. 49 is the *pyrosoma atlanticum*, belonging to the acephalous mollusca.

Many species of medusæ exhibit a strong light; the most splendid of these with which we are acquainted is the *pellucens*, fig. 20; which was taken from the sea at the same time with the *cancer fulgens*, by Sir Joseph Banks, in the passage from Madeira to Rio de Janeiro. The *medusa pellucens* emits flashes of light during its contractions, which are so vivid as to affect the sight of those who witness it. When the water, in which these animals and the *cancer fulgens* were contained, was emptied out of a bucket, it appeared like a stream of fire or fused gold.

Spallanzani discovered a medusa in the strait of Messina, which he describes as being exceedingly luminous; he says it blazes like a torch, and is visible thirty-five feet under the surface of the water. Its light, however, is variable; sometimes it continues for a quarter or half an hour, and even longer; at others it becomes suddenly extinct, and re-appears after a considerable interval. He accounts for this cessation by supposing that it is while the animal is at perfect rest.

Fig. 10 is the *medusa campanula*.

Fig. 17 is the *medusa scintillans*, greatly magnified; which shows the opaque parts upon the sides and centre of the animal. The two small globules below this figure represent the animals in the natural size.

Fig. 16 is a figure of the *medusa lucida*, the size of the largest specimens which are to be met with.

Fig. 20 is the *medusa pellucens*, which was discovered by Sir Joseph Banks; about one-fourth the natural size.

Riville, while on the coast of Malabar, noticed that the sea around his vessel exhibited a brilliant phosphorescent appearance; he caused some water to be drawn up, and having strained it, it no longer presented a luminous appearance; but he found the cloth covered with luminous specks, that resembled the ova of fish, both in form and size. On examining them with a lens, he perceived that they had internal motion, and on some of them being put into the water, they swam quickly about. One of these was seized with a pair of forceps, which caused it to shed a shining liquor of a blue colour, which illuminated the water for several lines. We have given a representation of this animal at fig. 32.

Captain Horsburg, and many others since his time, have ascertained that the luminous state of the sea, between the tropics, is caused by marine animals floating upon the surface of the water. Fig. 51 represents one of the animals which he discovered.

Mr. Baird, in mentioning the *medusa scintillans*, says, that their size is about that of a grain of sand; but, when seen shining in the water, their apparent size was very much increased. Upon taking up a bucket full of water from alongside the ship, and pouring it upon the deck, innumerable spots might be seen about the size of small peas, which, when taken up on the finger, and carried to a light, were scarcely discernible to the naked eye. Magnified thus by the refraction of the water and their own light, when the countless millions of them were scattered about upon the surface of the sea, upon its being agitated and set in motion by the ship's way through it, the appearance then presented was beautiful in the extreme. He mentions having met with a single specimen of medusa, in the straits of Banca, which he placed in a wine-glass full of clean sea-water, and kept it till evening. When taken to a dark place, the water upon its surface being struck and agitated by the finger, immediately gave out several bright sparks. This luminousness, however, soon ceased, the agitation of the water being continued; but when left undisturbed for some time, it seemed to recover its power, again emitting flashes of light upon being struck smartly with the top of the finger.

Dr. MacCulloch states, that the luminous appearance of the sea is never seen when the ocean presents a blue colour, as then there are no animalcules present in it. Mr. Baird, however, says, that he has frequently caught animalcules in it while it appeared blue; and he denies the assertion, that the luminous appearance is a precursor of a storm; and that, on the contrary, he conceives that they rather retire to the depths of the ocean before a change of weather.

It seems evident from all the observations which have been made, that the luminousness of the ocean depends in a great measure upon the animals above described, and others. But Mr. D. Sharpe, in a voyage to Lisbon, particularly examined water presenting a phosphorescent appearance, emitting a light resembling the smallest stars in brightness. When a bucketful was taken up, nothing was visible until it was shaken, when it was instantly filled with spangles, which disappeared as the water settled. On carefully examining this water with a microscope, nothing could be detected but an abundance of small fibres and shreds of apparently animal matter; and hence he infers that the phosphorescence of the ocean in some cases arises from the particles of dead fishes, &c.

PLATE XXVII.—ECHINODERMATA, ENTOZOA, INFUSORIA, MOLLUSCA, ACALEPHA, ANNELIDA, AND PHOSPHORESCENT ANIMALS.

Echinodermata.

Figs. 1, 2, 3, 5, 11, 12, 26

Entozoa.

Figs. 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68.

Infusoria.

Figs. 23, 28, 29, 30, 31, 35, 36. 37, 38, 40, 41, 43, 44, 45, 46, 47, 50, 53, 54.

Mollusca.

Figs. 6, 7, 8, 9, 25, 52.

Acalepha.

Figs. 10, 16, 17, 20.

Annelida.

Figs. 4, 13, 14, 15, 39.

Phosphorescent Animals.

Figs. 10, 16, 17, 18, 19, 20, 21, 22, 24, 27, 32, 33, 34, 42, 48, 49, 51.

Fig.
1 Echinus esculentus.
2 Asterias rubens.
3 Fistularia digitata.
4 Halithea aculeata.
5 Spatangus purpureus.
6 Medium Cuttle Fish.
7 Onhidium Typha.
8 Laphysia deplians.
9 Doris Argus.
10 Medusa campanula.
11 Actinia verrucosa.
12 Holothurus inhærens.
13 Hirudo geometra.
14 Spio quadricornis.
15 Nais vermicularis.
16 Medusa lucida.
17 Medusa scintillans.
18 Beroe fulgens.
19 Animalculum discovered by Forster.
20 Medusa pellucens.
21 Elater noctilucus.
22 Do. Magnified representation of luminous appearance.

Fig.
23 Brachionus Bakeri, p. 637, ii.
24 One of the sacs of the Glow-worm.
25 Limax ater.
26 Holothura squamata.
27 Cancer fulgens.
28 Vorticella Anastatica, p. 635, ii.
29 Cercaria inquieta, p. 632, ii.
30 Enchelis punctifera, p. 628, ii.
31 Vibrio paxillifer, p. 629, ii.
32 Crustacea discovered by Riville.
33 Nereis noctiluca.
34 Common Glow-worm.
35 Volvox globator, p. 628, ii.
36 Vibrio vermiculus.
37 Trichoda Sol, p. 633, ii.
38 Trichoda Cometa, p. 633, ii.
39 Lumbricus terrestris, p. 585, ii.
40 Vibrio lineola.
41 Enchelis farcimen.
42 Magnified view of inferior surface of Lampyris lucida.
43 Cercaria turbo.
44 Vibrio lunula, p. 629, ii.
45 Enchelis retrograda, p. 628.

Fig.
46 } Trichoda vermicularis.
47 }
48 Nereis phosphoranus.
49 Pyrsoma Atlanticum.
50 Trichoda farcimen, p. 633, ii.
51 Simulus noctilucus.
52 Lingulata abrupta.
53 Trichoda bomba, p. 633, ii.
54 Leucophra cornuta, p. 632, ii.
55 Filaria medinensis.
56 Broad Tape-worm.
57 Ascaris lumbricoides.
58 } Oxyuris vermicularia, { male.
59 } { female.
60 } Tricocephalus dispar, { male.
61 } { female.
62 } Oxyuris angulata, { male.
63 } { female.
64 Cysticercus cellulosæ.
65 Strongylus gigas.
66 Hamularia subcompressa.
67 Tænia.
68 Common Tape-worm.

PLATE XXX.—POLYPI. (P. 563–567. Vol. ii.)

Fig.
1 Cells of fig. 12.
2 Flabellaria incrassata.
3 Antennularia ramosa. See figs. 55, 56.
Sertularia frutescens. See fig. 10.
5 Spongia tubulosa.
6 Corallium rubrum.
7 Do.
8 Gorgonia verriculata
9 Alcyonium Gorgonoides.
10 Sertularia frutescens.
11 Corallina corniculata.
12 Flustra foliacea.
13 Umbellularia Greenlandica.
14 Pennatula phosphorea.
15 Lobularia digitata.
16 Do.

Fig.
17 Flabellaria pavonia.
18 Penicillus capitatus.
19 Do.
20 Antipathes spiralis.
21 Isis hippuris.
22 Oculina prolifera.
23 Seriatopora subulata.
24 Madrepora fungitus.
25 Porites clavaria.
26 Asteria denticulata.
27 Astrea radiata.
28 Explanaria mesenterina.
29 Meandrina labyrinthica.
30 Agarica ampliata.
31 Pavonia agaracites.
32 No fig.
33 Caryophillia cyathus.

Fig.
34 Tubipora musica.
35 Millepora calcarea.
36 Retepora cellulosa.
37 Eschara foliacea.
38 Cellepora pumicosa.
39 Do.
40 Tubulipora transversa.
41 } Parts of Do.
42 }
43 Dichotomaria fructiculosa.
44 ——— obtusata.
45 Anguinaria spatulata.
46 Do.
47 Callaria thuia.
48 Do.
49 Liriozoa Caribæa.
50 Do.

(Plate XXX.—Polypi. Continued.)

Fig.
51 52 } Serialaria lendigera.
53 54 } Plumularia myriophillum.
55 56 } Antennularia ramosa.
57 58 } Campanularia verticillata.
59 60 } Tubularia ramosa.

Fig.
61 62 63 64 } Flustra carbasea.
65 No fig.
66 See fig. 34.
67 68 } Caryophyllia Smithii.
69 Hydra viridis. See fig. 76.

Fig.
70 Spongia coalita.
71 72 } Spicula of fig. 5.
73 Sertularia abietina.
74 Tubularia magnifica.
75 Vorticella polypina.
76 Hydra viridis.
77 See fig. 73.
78 Flustra verticilliata.

PLATE XXXI.—CONCHOLOGY.

P. 354-355, Vol. ii.

Fig.
1 Carnaria Cymbium.
2 Argonauta argo.
3 Nautilus pompilius.
4 Spirula Peronii.
5 Nodosaria radicula.
6 Conus betulinus.
7 Oliva Utriculus.
8 Ancillaria glandiformis.
9 Terebellum subulatum.
10 Cypræa lynx.
11 Ovula verrucosa.
12 Volvaria cylindrica.
13 Marginella bivaricostata.
14 Voluta scapha.
15 Mitra tæneata.
16 Columbella rustica.
17 Terebra vittata.
18 Eburna spirata.
19 Buccinum lineolatum.
20 Dolium tesselatum.
21 Harpa nobilis.
22 Concholepas Peruvianus.
23 Monoceros glabratum.
24 Purpura bicostalis.
25 Recinula arachnoides.
26 Cassis areola.
27 Cassidaria echinophora.
28 Strombus succinctus.
29 Pterocera millepeda.
30 Rostellaria columbina.
31 Triton scorbiculator.
32 Murex acanthopterus.
33 Ranella granulata.
34 Struthiolaria nodulosa.
35 Fyrula reticulata.
36 Fusus longicaudata.
37 Fasciolaria tulipa.
38 Cancellaria asperella.

Fig.
39 Turbinella scolymus.
40 Pleurotoma Babylonia.
41 Cerithium aluco.
42 Turitella duplicata.
43 Phasianella varia.
44 Planaxis undulata.
45 Turbo smaragdus.
46 Monodonta canalifera.
47 Trochus papillosus.
48 Rotella vestrarius.
49 Solarium variegatum.
50 Delphinula laciniata.
51 Scalaria coronata.
52 Vermetus lumbricalis.
53 Pyramidella maculosa.
54 Tornatella flammea.
55 Haliotis tuberculata.
56 Stomalia phymotis.
57 Stomatella auricula.
58 Sigaretus Haliotoideus.
59 Janthina exigua.
60 Natica stercus muscarum.
61 Nerita peloronta.
62 Neritina punctulata.
63 Navicella tessalaria.
64 Ampullaria rugosa.
65 Paludina vivipara.
66 Valvata depressa.
67 Pilena Madagascarensis.
68 Melanopsis costata.
69 Melania granifera.
70 Lymnæo auricularia.
71 Physa hypnorum.
72 Planorbis corneus.
73 Cyclostoma bistriatus.
74 Auricula felis.
75 Succinea amphibia.
76 Achatina perdix.

Fig.
77 Bulimus radiatus.
78 Clausilia ventricosa.
79 Pupa unidentata.
80 Helicina major.
81 Anastoma globosa.
82 Carocolla Madagascarensis.
83 Helix nemoralis.
84 Vitrina elongata.
85 Testacella Haliotoidea.
86 Limax rufus.
87 Parmacella Olivieri.
88 Dolabella callosa.
89 Laplysia radiata.
90 Bulla amygdala.
91 Bullæa catena.
92 Ancylus fluviatilis.
93 Crepidula fornicata.
94 Calyptræa sinense.
95 Pileopsis Ungarica.
96 Fisurella Græca.
97 Emarginula fissura.
98 Parmophorus Australis.
99 Umbrella Indica.
100 Pleurobranchus plumula.
101 Patella vulgata.
102 Chiton marginatus.
103 Chitonellus striatus.
104 Cymbulia proboscidea.
105 Limacina helicialis.
106 Cleodora pyramidata.
107 Hyalœa cuspidata.
108 Parmacella Calyculata.
109 Akera flexilis.
110 Utriculus obtusa.
111 Galericulum lævigatum.
112 Neritoides litteralis.
113 Sipho striata.

PLATE XXXII.—CONCHOLOGY.

P. 355, Vol. ii.

Fig.
1 Lingula anatina.
2 Orbicula Norwegica.
3 Terebratula vitrea.
4 Crania striata.
5 Discina ostreoides.
6 Anomia Ephipphium.
7 Placuna sella.
8 Vulsella spongiarum.
9 Ostrea cornucopiæ.
10 Gryphæa secunda.
11 Podopsis truncata.
12 Spondylus spatuliformis.
13 Plicatula cristata.
14 Pecten radula.
15 Phlagiostoma semilunaris.
16 Lima fragilis.
17 Pedum spondyloideum.
18 Maleagrina margaritifera.
19 Avicula obliqua.
20 Malleus vulgaris.
21 Perna isognomum.
22 Crenatula phasianoptera.

Fig.
23 Pinna elegans.
24 Mytilus afer.
25 Modiola papuana.
26 Hippopus maculatus.
27 Tridacna squamosa.
28 Etheria elliptica.
29 Chama arcinella.
30 Dicoras arietina.
31 Iridina exotica.
32 Anadonta cygnea.
33 Hyria corrugata.
34 Unio irroratus.
35 Castalia ambigua.
36 Trigonia scabra.
37 Nucula tenuis.
38 Pectunculus pilosus.
39 Arca tortuosa.
40 Cucullœa auriculifera.
41 Isocardia Moltkiana.
42 Hiatella arctica.
43 Cypricardia coralliophaga.
44 Cardita crassicosta.

Fig.
45 Cardium elongatum.
46 Venericardia imbricata.
47 Ortygia sulcata.
48 Venus verrucosa.
49 Cytherea erycina.
50 Exoleta lincta.
51 Cyprina Islandica.
52 Lasæa rubra.
53 Galathea radiata.
54 Cyrena fuscata.
55 Cyclas cornea.
56 Pisidium obliqua.
57 Crassina sulcata.
58 Capsa Braziliensis.
59 Donax denticulata.
60 Lucina carnaria.
61 Mysia rotundata.
62 Corbis lamellosa.
63 Arcopagia crassa.
64 Tellinides roseus.
65 Tellina punicea.
66 Psammotæa variegata.

GENERAL INDEX OF PLATES.

(Plate XXXII.—Conchology. Continued.)

Fig.
67 Psammobia vespertina.
68 Sanguinolaria Occidens.
69 Venerupis iris.
70 Petricola Pholadiformis.
71 Saxicava Praecisa.

Fig.
72 Pandora rostrata.
73 Corbula sulcata.
74 Amphidesma Lucinalis.
75 Solemya Mediterranea.
76 Tellimya suborbicularis.

Fig.
77 Ungulina transversa.
78 Erycina striata.
79 Crassatella Kingicola.
80 Ligula tenuis.
81 Mactrina triangularis.

PLATE XXXIII.—CONCHOLOGY.

P. 356, Vol. ii.

Fig.
1 Matra stultorum.
2 Lutraria compressa.
3 Anatina convexa.
4 Mya arenaria.
5 Galeomma Turtoni.
6 Magdala striata.
7 Myatella striata.
8 Crenella elliptica.
9 Spenia Binghami.
10 Glycimeris Siliqua.
11 Panopea Aldrovandi.
12 Solen vagina.
13 Gastrochæna modiolina.
14 Pholas dactylus.
15
16 } Teredo navalis.
17
18
19 Teredina personata.
20 Septaria arenaria.
21 } Fistulana clava.
22
23 } Clavagella aperta.
24
25 Aspergillum Javanum.
26 Otion Cuvieri.
27 Cineris vittata.
28 Pollicipes mitella.
29 Scalpellum vulgare.
30 Anatifa vitrea.
31 Pyrgoma crenata.

Fig.
32 Creusia verruca.
33 Acasta Montagui.
34 } Adna Anglica.
35
36 Balanus Cranchii.
37 Coronula testudinaria.
38 Tubicinilla balænarum.
39 Magilus antiquus.
40 Galeolaria recumbens.
41 Vermilia triquetra.
42 Serpula tubularia.
43 Spirorbis spirillum.
44 Amphitrite ventilabrum.
45 Terebella conchilega.
46 Sabellaria crassissima.
47 Pectinaria Belgica.
48 Dentalium entalis.
49 Brochus reticulatus.
50 Cornuoides minor.
51 Siliquaria anguina.
52 Operculum of Nerita Undulata.
53 Phasianella Bulimoides.
54 Trochus Pharaonis.
55 Melania Byronensis.
56 Nerita fluviatilis.
57 Panludina achatina.
58 Turbo Pica.
59 Neritoides littoralis.
60 Murex Brandaris.
61 Buccinum undatum.

Fig.
62 Strombus Auris-Dianæ.
63 Trochus littoralis.
64 Animal of the Monodonta Pica.
65 Fusus antiquus.
66 Voluta vespertilio.
67 Lusus naturæ of Helix Pomatia.
68 Spirula Peronii.
69 Cassis ariola.
70 Cypræa exanthema.
71 Clausina ventricosa.
72 Planorbis Planata.
73 Crepidula aculeata
74 Fusus discrepans.
75 Dolium galea.
76 Turitella terebra.
76* Helix Umblicata.
77 Cytherea Chione.
78 Hinge of Lutraria elliptica.
79 Solen truncatus.
80 Cardium elongatum.
81 Spondylus gæderopus.
82 Anomia squamula.
83 Cardium edule.
84 Venus cassina.
85 Pecten obsoletus.
86 Pholas candidus.
87 Anatifa striata.
88 Balanus communis.
89 Operculum of Balanus Cranchii.
90 Chiton cinereus.

The reference letters in connection with various figs. in Plate 33 are explained at pp. 356–358.

PLATES XXXIV. AND XXXV.—MICROSCOPIC OBJECTS.

The Figures in these Plates are numbered continuously.

Fig.
1 Hair of the Dermestes, p. 603, ii.
2 ——— Mouse, p. 603, ii.
3 ——— Bat, p. 603, ii.
4 ——— Bee, p. 603, ii.
5 ——— Dormouse, p. 603, ii.
6 ——— Mole, p. 603, ii.
7 ——— Caterpillar, p. 603, ii.
8 Filament of a Feather, p. 604, ii.
9 Filament of Thistle Down, p. 598, ii.
10 Scale of Red Underwing Butterfly, p. 618, ii.
11
12 } Scales of the Cabbage Butterfly, p. 618, ii.
13
14 Scale of Menelaus Butterfly, p. 619, ii.
15 ——— Papilio, p. 619, ii.
16 ——— Azure Blue Butterfly, p. 619, ii.
17 ——— Podura Plumbea, p. 618, ii.
18 ——— Lepisma, p. 619, ii.
19 ——— Diamond Beetle, p. 619, ii.
20 ——— Moth, p. 619, ii.
21 Disposition of the Scales on the Wings of Papilio, p. 619, ii.
22 Wing of a Gnat, p. 617, ii.
23 ——— Ichneumon Fly, p. 617, ii.
24 Foot of a Dytiscus, p. 616, ii.
25 Wing of an Earwig, p. 617, ii.
26 Part of a Humming Bird's Feather, p. 604, ii.
27 Section of a Hedge-hog's Quill, p. 602, ii.
28 Pollen of Marshmallow, p. 598, ii.
29 Seed of Calampelus Scaber, p. 599, ii.
30 Seed of French Marygold, p. 599, ii.
31 Humming Bird's Feather, p. 604, ii.
32 Trunk of Papilio Urticæ, p. 615, ii.
33 Seed of Polypodium, p. 599, ii.
34 Feather of Humming Bird, p. 684, ii.

Fig.
35 } Feather of Humming Bird, p. 604, ii.
36
37 Leaf of Bog Moss, p. 600, ii.
38 Sea Weed, p. 601, ii.
39 Section of Aloë, p. 602, ii.
40 Fibres of the Palm, p. 602, ii.
41 Microscopic Insect, p. 593, ii.
42 Theca, or Seed Vessel, of Moss, p. 599, ii.
43 Trunk of the Honey Bee, p. 616, ii.
44 } Crystals of Common Salt, p. 589, ii.
45
46 Crystals of Saliva, p. 590, ii.
47 Crystals of Common Salt, p. 590, ii.
48 Do., p. 590, ii.
49 Section of Clematis, p. 602, ii.
50 } Snow Flakes, p. 589, ii.
51
52 Crystals of Common Salt, p. 590, ii.
53 Brachionus passus, p. 637, ii.
54 Bracelet Leucophra, p. 632, ii.
55 Common Trichoda, p. 633, ii
56 Kerona pullaster, p. 634, ii.
57 Vorticella cyathini, p. 635, ii.
58 Himantopus larva, p. 634, ii.
59 Green Cercaria, p. 632, ii.
60 Swallow-like Bursaria, p. 632, ii.
61 Egg-shaped Enchelis, p. 628, ii.
62 Azure Cyclidium, p. 630, ii.
63 Paramæcium chrysalis, p. 631, ii.
64 Cuckoo Kolpoda, p. 631, ii.
65 The Drop Monad, 626, ii.
66 Melting Proteus, p. 627, ii.
67 Vegetable Volvox, p. 627, ii.
68 Vibrio Paxillifer, p. 629, ii.
69 Breastplate Gonium, p. 631 ii.

COLOURED PLATES.

PLATE XXXVI.

Fig.	Popular Name.	Scientific Name.
1.	Addax Antelope	*Antilope Addax.*
2.	Koodoo Antelope	*Antilope strepsiceros.*
3.	Pallah Antelope	*Antilope melampus.*
4.	Kevel Antelope	*Antilope Kevella.*
5.	Springbok Antelope	*Antilope Euchore.*
6.	Salt's Antelope	*Antilope Saltiana.*
7.	Takhaitze Antelope	*Antilope barbata.*
8.	Nylgau	*Antilope picta.*

PLATE XXXVII.

1.	Red Deer. *Hart*	*Cervus elaphus.*
2.	Do. *Hind*	*do. do.*
3.	Roebuck	*Cervus capreolus.*
4.	Thibetan Musk-deer	*Moschus moschiferus.*
5.	Reindeer. *Male.* Summer dress	*Cervus tarandus.*
6.	Reindeer. *Female.* Summer dress	*do. do.*
7.	Guazupuco-deer	*Cervus paludosus.*
8.	Stag of Palestine	
9.	Spotted Axis-deer	*Cervus Axis.*
10.	Guazuti Deer	*Cervus campestris.*
11.	Great Rusa	*Cervus hippelaphus.*
12.	Stag of the N. of Europe	*Cervus elaphus var.*
13.	Wapiti Stag	*Cervus Canadensis.*
14.	Fallow-deer. *Buck*	*Cervus Dama.*
15.	Do. *Doe*	*do. do.*

PLATE XXXVIII.

1.	Wild Boar	*Sus scrofa.*
2.	Collared Peccary	*Dycotyles torquatus.*
3.	Chinese Sow	*Sus scrofa var. Chin.*
4.	Capibara	*Hydrochærus capybara.*
5.	Babyroussa	*Sus Babyroussa.*

PLATE XXXIX.

1.	Asiatic Lion	*Felis Leo.*
2.	Asiatic Lioness	*do.*
3.	Bengal Tiger	*Felis Tigris.*
4.	Leopard	*Felis Leopardus.*
5.	Jaguar	*Felis onça.*

PLATE XL.

1.	European Wolf	*Lupus vulgaris.*
2.	Black Wolf of N. America	*Lupus lycaon.*
3.	Alpine or Great Bernard Dog	
4.	Highland greyhound	*Canis Scoticus.*
5.	Great Dog of Nepaul	*Canis primævus.*

PLATE XLI.

1.	American Black Squirrel	*Sciurus niger.*
2.	Ariel Petaurus	*Petaurus ariel.*
3.	Squirrel-like Petaurus	*Petaurus sciureus.*
4.	Lesser American Flying Squirrel	*Sciuropterus volucella.*
5.	Grey Squirrel	*Sciurus cinereus.*
6.	Do.	*do. do.*
7.	Common Squirrel	*Sciurus vulgaris.*
8.	Common Ground Squirrel	*Sciurus striatus.*
9.	Agiump Squirrel	*Sciurus setosus.*

PLATE XLII.

Fig.	Popular Name.	Scientific Name.
1.	Greenland or Harp Seal. *Male*	*Phoca Grœnlandica.*
2.	Greenland or Harp Seal. *Female*	*do. do.*
3.	Pennant's pied Seal	*Phoca bicolor.*
4.	Marbled Seal	*Phoca discolor.*
5.	Common Seal	*Phoca vitulina.*
6.	Walrus or Sea-horse	*Trichecus rosmarus.*
7.	Fur Seal of Commerce	*Otaria Falklandica.*
8.	Do. do.	*do. do.*

PLATE XLIII.

1.	Red Orang-outang	*Pithecus satyrus.*
2.	Diana Monkey	*Cercopithecus Diana.*
3.	Guereza Monkey	*Colobus Guereza.*
4.	Varied Monkey	*Cercopithecus mona.*
5.	Collared White-eyelid Monkey	*Cercocebus Æthipos.*
6.	Green Monkey.	*Cercocebus Sabæus.*

PLATE XLIV.

1.	Lord Derby's Kangaroo	*Macropus Derbianus.*
2.	Aröe Kangaroo	*Macropus ualabatus.*
3.	Parry's Kangaroo	*Macropus Parryi.*
4.	Woolly Kangaroo	*Macropus lanigerus.*
5.	Brush-tailed Kangaroo	*Macropus penicillatus.*
6.	Rat-tailed Hypsiprymnus	*Hypsiprymnus Murinus.*
7.	Rabbit-eared Perameles	*Perameles lagotis.*

PLATE XLV.

1.	Asiatic Elephant. *Male*	*Elephas Indicus.*
2.	Do. do. *Female*	*do. do.*
3.	Do. do. *Young*	*do. do.*
4.	Caparisoned Elephant	*do. do.*

PLATE XLVI.

1.	Hippopotamus	*Hippoptamus amphibius.*
2.	Indian Rhinoceros	*Rhinosceros Indicus.*
3.	Muchoco White Rhinoceros	*Rhinosceros simus.*
4.	Two-horned Rhinoceros	*Rhinosceros Africanus.*
5.	Do. do.	*do. do.*
6.	Malay Tapir	*Tapir Malayanus.*

PLATE XLVII.

1.	Bactrian Camel	*Camelus Bactrianus.*
2.	Arabian Camel or Dromedary	*Camelus dromedarius.*
3.	Dromedaries caparisoned	*do. do.*
4.	Do. do.	*do. do.*
5.	Post Camel of India	*do. do. variety.*

PLATE XLVIII.

1.	Grisly Bear	*Ursus ferox.*
2.	European Brown Bear	*Ursus Arctos.*
3.	American Black Bear	*Ursus Americanus.*
4.	Polar Bear	*Ursus maritimus.*

PLATE XLIX.

Fig.	Popular Name.	Scientific Name.
1.	Great Sea Eagle	*Haleaëtus albicilla.*
2.	Golden Eagle	*Aquila chrysaëtos.*
3.	Small Cape Eagle	*Aquila vulturina.*
4.	Wedge-tailed Eagle	*Aquila fucosa.*

PLATE L.

1.	White-headed Sea Eagle	*Haliaëtus leucocephalus*
2.	Great-harpy Eagle	*Harpyia destructor.*
3.	Chilian Sea Eagle	*Haliaëtus Aguia.*
4.	Brazilian Caracara Eagle	*Polyborus vulgaris.*

PLATE LI.

1.	King of the Vultures	*Sarcoramphus Papa.*
2.	Sociable Vulture.	*Vultur auricularis.*
3.	Bearded Vulture or Lammergeyer	*Gypaetus barbatus.*
4.	Griffon Vulture	*Vultur fulvus.*
5.	Condor	*Sarcoramphus Gryphus.*

PLATE LII.

1.	Gyr Falcon or Gerfalcon	*Falco gyrfalco.*
2.	Goshawk	*Astur palumbarius.*
3.	Kite or Glead	*Milvus vulgaris.*
4.	Peregrine Falcon	*Falco peregrinus.*
5.	Kestril. *Female*	*Falco tinnunculus.*

PLATE LIII.

1.	Game Cock	*Gallus domesticus.*
2.	Silver-spangled Polish Cock	
3.	White-feathered Bantam Hen	
4.	Dorking Hen	*Gallus pentadactylus.*
5.	Black-polish Hen	
6.	Malay Cock	
7.	Malay Hen	

PLATE LIV.

1.	Common Peacock	*Pavo cristatus.*
2.	Ringed Pheasant	*Phasianus torquatus.*
3.	Horned Pheasant	*Tragopan Hastingsii.*
4.	Silver Pheasant	*Phaisianus nychthemerus.*

PLATE LV.

1.	American Wild Turkey	*Maleagris gallopavo.*
2.	Crested Curassow	*Crax Alector.*
3.	Galeated Curassow	*Ourox Pauxi.*
4.	Red Curassow	*Crax rubra.*

PLATE LVI.

1.	Red Grouse	*Tetrao Scoticus.*
2.	Common Partridge	*Perdix cinerea.*
3.	Black Cock or Black Grouse	*Tetrao tetrix.*
4.	Grey Hen, female of Black Grouse	*do. do.*
5.	Common or White Ptarmigan	*Lagopus mutus.*

PLATE LVII.

Fig.	Popular Name.	Scientific Name.
1.	Ivory-billed Woodpecker	*Picus principalis.*
2.	Green Woodpecker	*Picus viridis.*
3.	Great-spotted Woodpecker	*Picus major.*
4.	Lesser-spotted Woodpecker	*Picus minor.*

PLATE LVIII.

1.	Song Thrush	*Turdus musicus.*
2.	Ring-ouzel	*Turdus torquatus.*
3.	Blackbird	*Turdus merula.*
4.	Wheat-ear	*Saxicola œnanthe.*
5.	Sky-lark	*Alauda arvensis.*
6.	Redbreast	*Erythaca rubecula.*

PLATE LIX.

1.	Lesser Redpole	*Linaria minor.*
2.	Goldfinch. *Male*	*Carduelis elegans.*
3.	Do. *Female*	*Do. do.*
4.	Siskin or Aberdevine	*Carduelis spinus.*
5.	Reed Bunting	*Emberiza schœniculus.*
6.	Golden-crested Wren	*Regulus cristatus.*

PLATE LX.

1.	Bar-tailed Humming-bird	*Trochilus sparganurus.*
2.	Stoke's Humming-bird	*Trochilus Stokesii.*
3.	Underwood's Humming-bird	*Trochilus Underwoodii.*
4.	Gould's Humming-bird	*Trochilus Gouldii.*
5.	Topaz-throated Humming-bird	*Trochilus Pella.*

PLATE LXI.

1.	Common Crane	*Grus cinerea.*
2.	White Stork	*Ciconia alba.*
3.	Gigantic Crane	*Ciconia argala.*
4.	Common Heron	*Ardea cinerea.*
5.	Little Egret	*Ardea garzetta.*

PLATE LXII.

1.	European Pied Oyster Catcher	*Haematopus ostralegus.*
2.	Grey Phalarope. Summer plumage	*Phalaropus lobatus.*
3.	Purre or Dunlin. Summer plumage	*Tringa variabilis.*
4.	Ringed Dotterel	*Charadrius hiaticula.*
5.	Turnstone. Summer plumage	*Strepsilas interpres.*

PLATE LXIII.

1.	Black-toed Gull	
2.	Richardson's Skua	*Lestris Richardsonii.*
3.	Glaucous Gull	*Larus glaucus.*
4.	Black Tern	*Sterna nigra.*
5.	Lesser Tern	*Sterna minuta.*

PLATE LXIV.

1.	Shoveler or Broad Bill	*Anas clypeata.*
2.	Common Teal	*Anas crecca.*
3.	Harlequin Duck	*Anas histrionica.*
4.	Scaup Duck. *Male*	*Anas marila*
5.	Do. do. *Female*	*do. do.*
6.	Red-headed Pochard	*Anas ferina.*

PLATE LXV.

Fig.	Popular Name.	Scientific Name.
1.	Salmon	*Salmo salar.*
2.	Gilse or Young Salmon	*do. do.*
3.	Salmon Trout	*Salmo trutta.*
4.	Great Lake Trout	*Salmo ferox var.*
5.	Lake Trout	*Salmo ferox.*
6.	Do. do.	*do. do.*
7.	Do. do.	*do. do.*
8.	River Trout	*Salmo fario.*
9.	Parr	

PLATE LXVI.

Fig.	Popular Name.	Scientific Name.
1.	Twaite Skad	*Alosa finita.*
2.	Herring	*Clupea harengus.*
3.	Do.	*do. do.*
4.	Sprats or Garvies	*Clupea sprattus.*
5.	Do. do.	*do. do.*
6.	Pilchard	*Clupea pilchardus.*
7.	Anchovy	*Engraulis encrasicolus.*
8.	White Bait	*Clupea alba.*
9.	Do. do.	*do. do.*

PLATE LXVII.

Fig.	Popular Name.	Scientific Name.
1.	Common Cod	*Morrhua vulgaris.*
2.	Haddock	*Morrhua Æglefinus.*
3.	Whiting	*Merlangus vulgaris.*
4.	Coal Fish or Scaithe	*Merlangus carbonarius.*
5.	Ling	*Lota molva.*
6.	Holibut	*Hippoglossus vulgaris.*
7.	Common Mackerel	*Scomber Scomber.*
8.	Smelt or Spirling	*Osmerus sperlanus.*

PLATE LXVIII.

Fig.	Popular Name.	Scientific Name.
1.	Anaconda	*Boa aquatica.*
2.	Pedda poda	*Python Tigris.*
3.	Port Natal Python	*Python natalensis.*
4.	Rattlesnake	*Crotalus horridus.*
5.	Do. Black variety	*do. var. niger.*
6.	Cobra de Capello	*Naja tripudians.*

PLATE LXIX.

Fig.	Popular Name.	Scientific Name.
1.	Peacock's Eye Butterfly	*Vanessa Io.*
2.	Camberwell Beauty	*Vanessa Antiopa.*
3.	Purple Emperor	*Apatura Iris.*
4.	Glanville Fritillary	*Melitæa Cinxia.*
5.	Grayling Butterfly	*Hipparchia Semele.*
6.	Green Hair-Streak	*Thecla Rubi.*
7.	Silver-studded Blue Butterfly	*Polyommatus Argus.*

PLATE LXX.

Fig.	Popular Name.	Scientific Name.
1.	Honey Bee. *Worker*	*Apis mellifica.*
2.	Do. do. *Male*	*do. do.*
3.	Do. do. *Queen*	*do. do.*
4.	Common-Humble Bee	*Bombus terrestris.*
5.	Do. do.	*do. do.*
6.	Lapidary or Red-tailed Bee. *Male*	*Bombus lapidarius.*
7.	Lapidary or Red-tailed Bee. *Female*	*do. do.*
8.	Moss or Carder Bee	*Bombus muscorum.*
9.	Donovan's Humble Bee	*Bombus Donovanellus.*
10.	Harris' Humble Bee	*Bombus Harrisellus.*
11.	False Humble Bee	*Apathus vestalis.*
12.	Do. do.	*Apathus rupestris.*

PLATE LXXI.

Fig.	Popular Name.	Scientific Name.
1.	Hercules Beetle	*Scarabæus Hercules.*
2.	Scarabeus Tityus	*Scarabæus Tityus.*
3.	Striped Click Beetle	*Elater lineatus.*
4.	Splendid Ground Beetle	*Calosoma sycophanta.*
5.	Beautiful Capricorn Beetle	*Lamia formosa.*
6.	Margined Malachius	*Malachius marginellus.*
7.	Beautiful Barncow Beetle	*Buprestis amœna.*
8.	Downy Weevil	*Rhynchites pubescens.*
9.	Latreilles Weevil	*Curculio Latreillii.*
10.	Coppery Eumolpus	*Eumolpus cupreus.*
11.	Spotted Lady-bird Beetle	*Coccinella punctata.*
12.	Noble Golden Beetle	*Chrysomela fastuosa.*

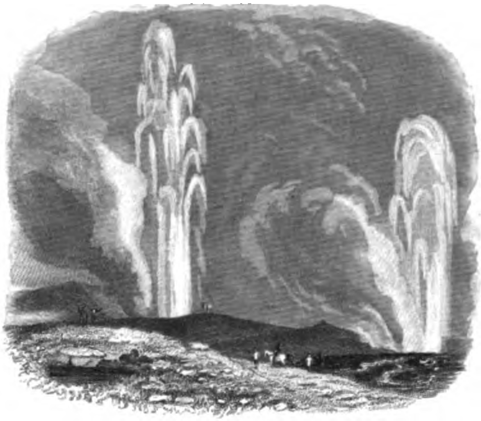
N. II. 1.

NATURAL SCENERY AND PHENOMENA.

VOLCANO.
Mount Vesuvius in eruption

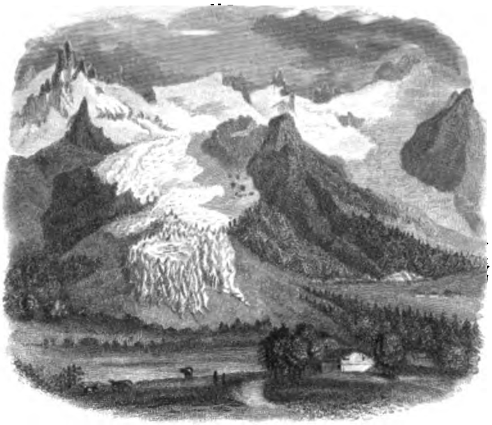
SIMOOM.
The sand-storm of the Desert

CATARACT.
Niagara – The horse shoe fall from below the Tower



BOILING SPRING.
The Great Geyser, Iceland.

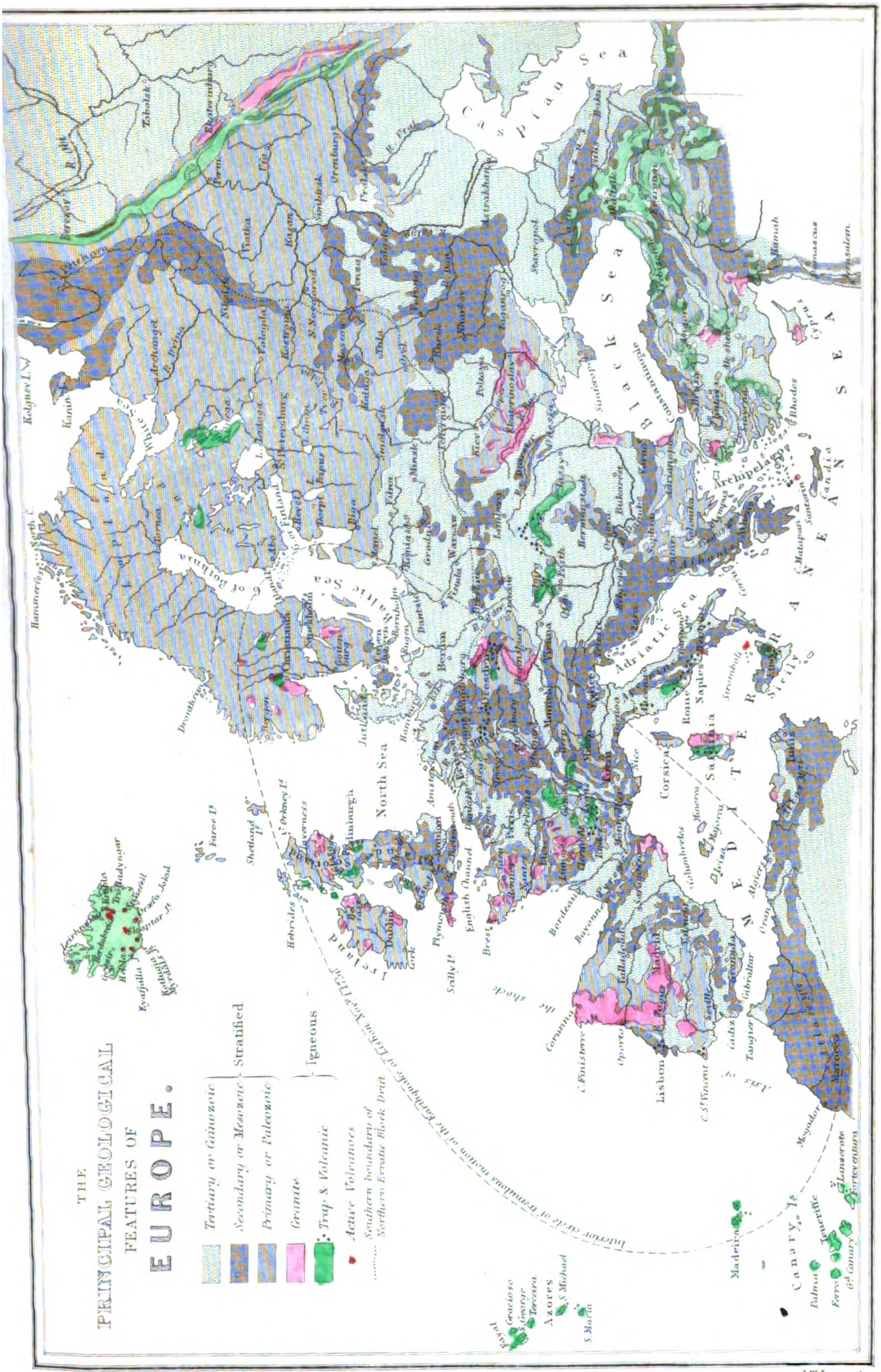
ICEBERG.
Iceberg seen near Kosoak by Dr Kane



GLACIER.
The Glacier of Bossons, valley of Chamouni.

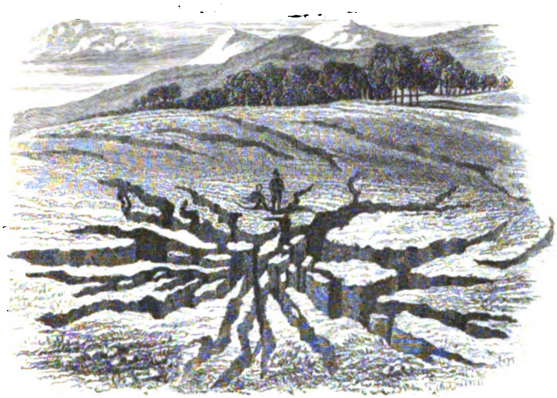
Engraved by R C Bell

BLACKIE & SON, GLASGOW, EDINBURGH & LONDON.



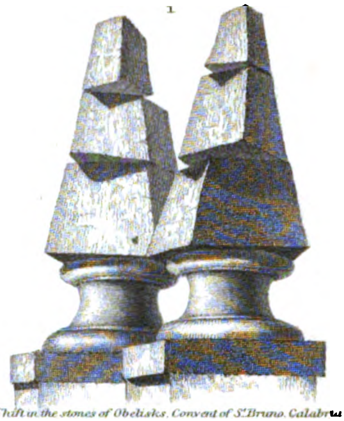
THE PRINCIPAL GEOLOGICAL FEATURES OF EUROPE.

2



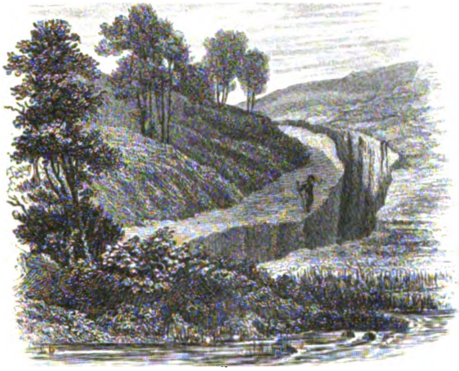
Fissures near Jerocarne, Calabria, caused by the Earthquake 1783

1



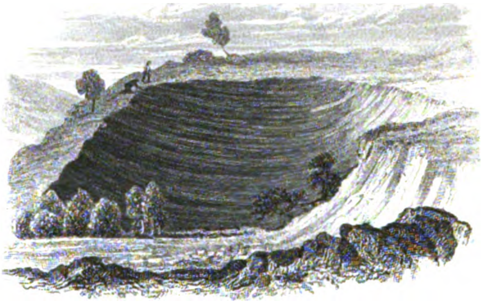
Shift in the stones of Obelisks. Convent of S^t. Bruno, Calabria.

3



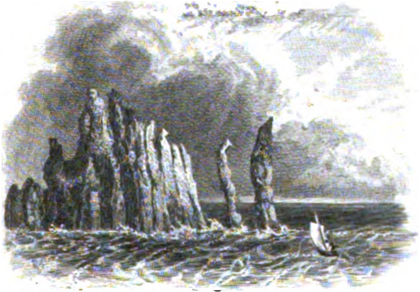
Chasm in the hill of S^t. Angelo near Soriano, Calabria, caused by the Earthquake 1783

4



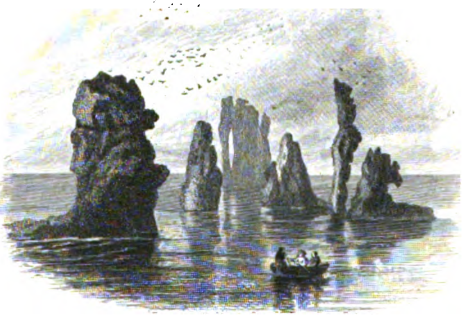
Chasm caused by the Earthquake of 1783 near Oppido, Calabria

6



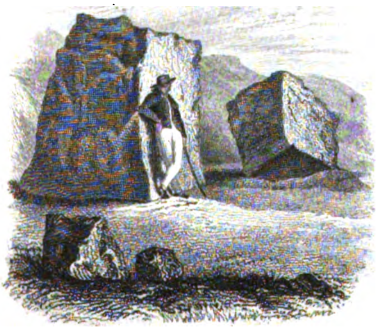
The Dongs. Granitic rocks between Papa stour & Hillswickness Shetland.

5



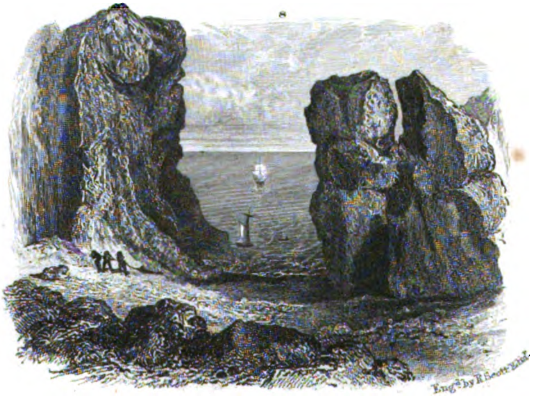
Granitic rocks to the south of Hillswick ness Shetland.

7



Stones drifted by the sea Northmavine. Shetland

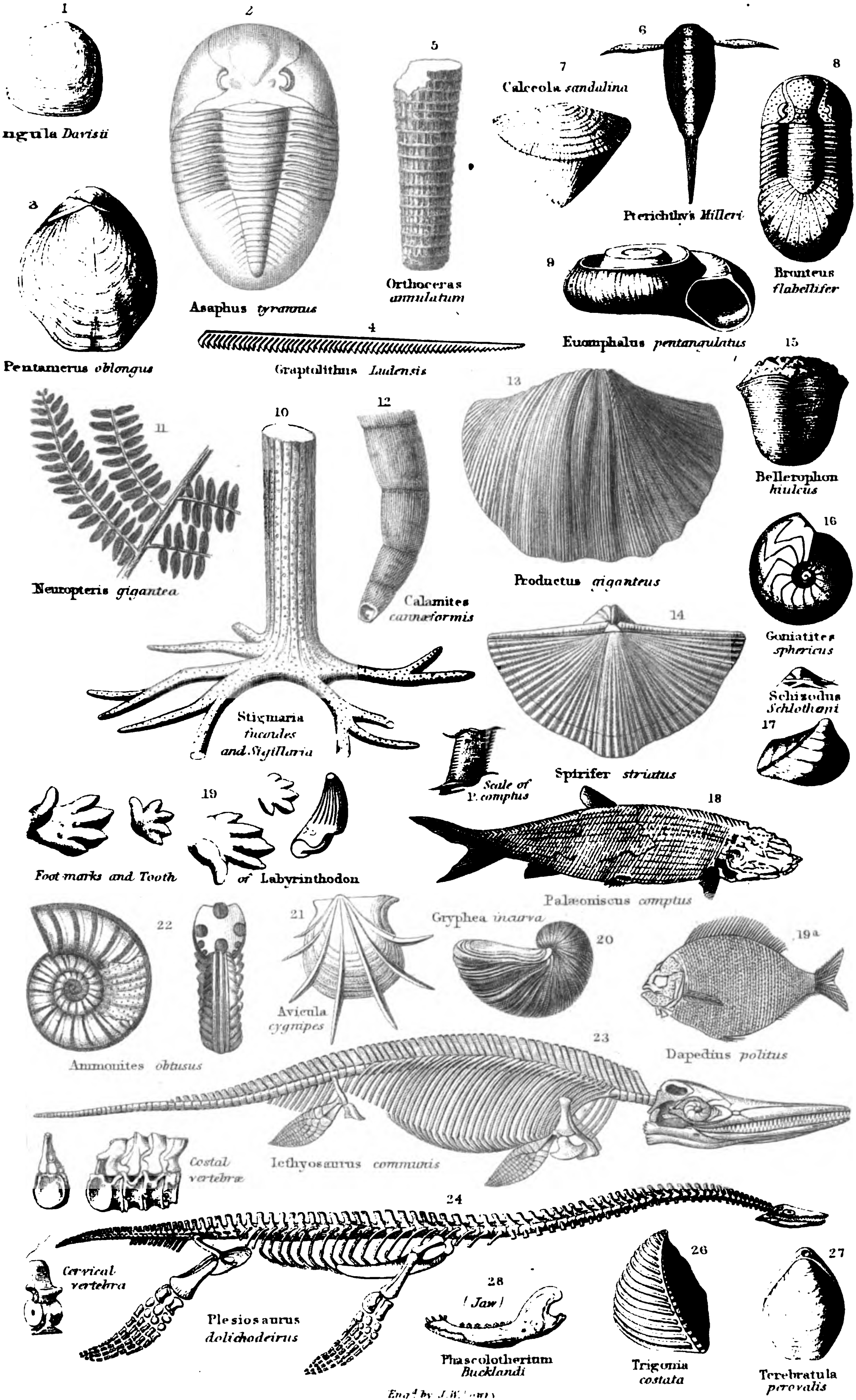
8


Eng^d by R. Scott Edin^r.

Grind of Navir - Passage made by the sea through rocks of Porphyry

Published by Blackie & Son Glasgow

PALEONTOLOGY.

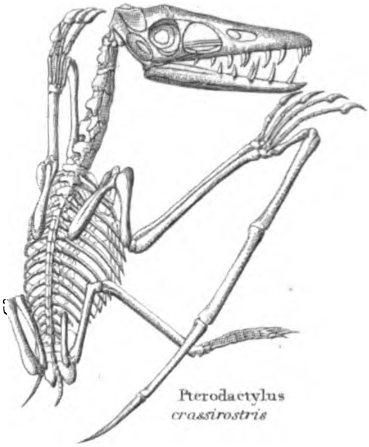


Eng^d by J.W. Lowry

BLACKIE & SON, GLASGOW; EDINBURGH & LONDON

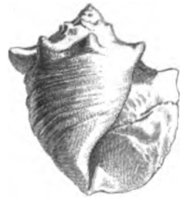
PALEONTOLOGY.

25



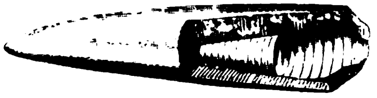
Pterodactylus *crassirostris*

29



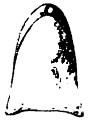
Purpuroidea *Morrisii*

31



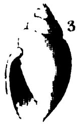
Belemnites *abbreviatus*

30



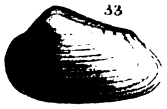
Terebratula *digona*

32



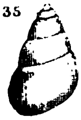
Physa *Bristovii*

33



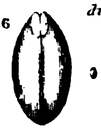
Unio *compressus*

35



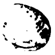
Paludina *Sussexiensis*

36



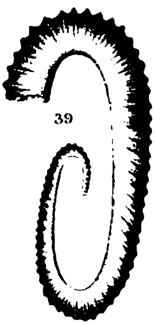
Cypris *Valdensis* (*magnified*)

34



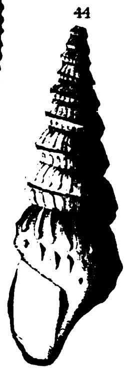
Cyclas *parva*

39



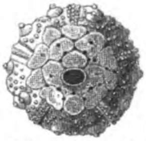
Hamites *rotundus*

44



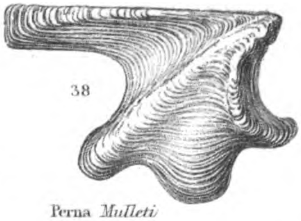
Turrilites *costatus*

37



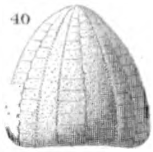
Salenia *punctata*

38



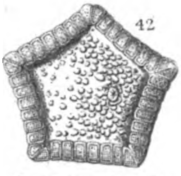
Perna *Mulleti*

40



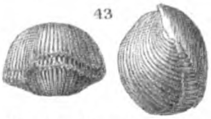
Galerites *albogalerus*

42



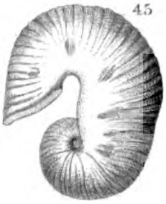
Goniaster *Coombii*

43



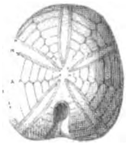
Rhynchonella *octoplicata*

45



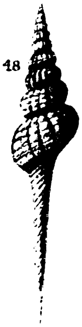
Scaphites *æqualis*

41



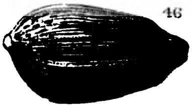
Nucleolites *dimidiatus*

48



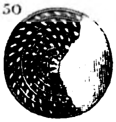
Fusus *porrectus*

46



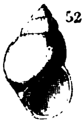
Nipadites *umbonatus*

50



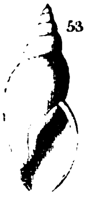
Nummulites *lævigata*

52



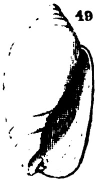
Paludina *lenta*

53



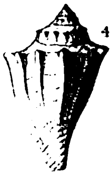
Lymnæa *longiscata*

49



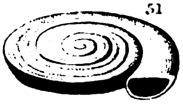
Oliva *Branderi*

47



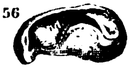
Voluta *spinosa*

51



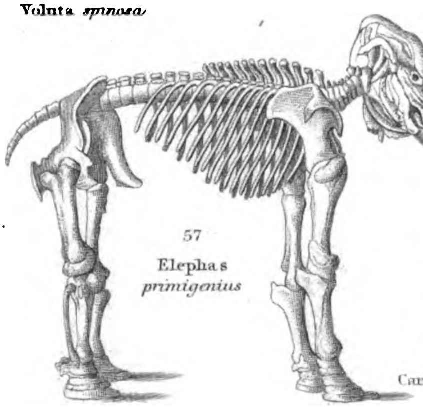
Planorbis *euomphalus*

56



Ear bone of
Balæna *emarginata*

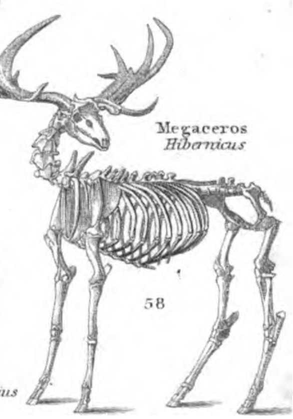
57



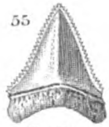
Elephas
primigenius

Megaceros
Hibernicus

58

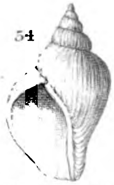


55



Tooth of
Carcharadon *megalodon*

54



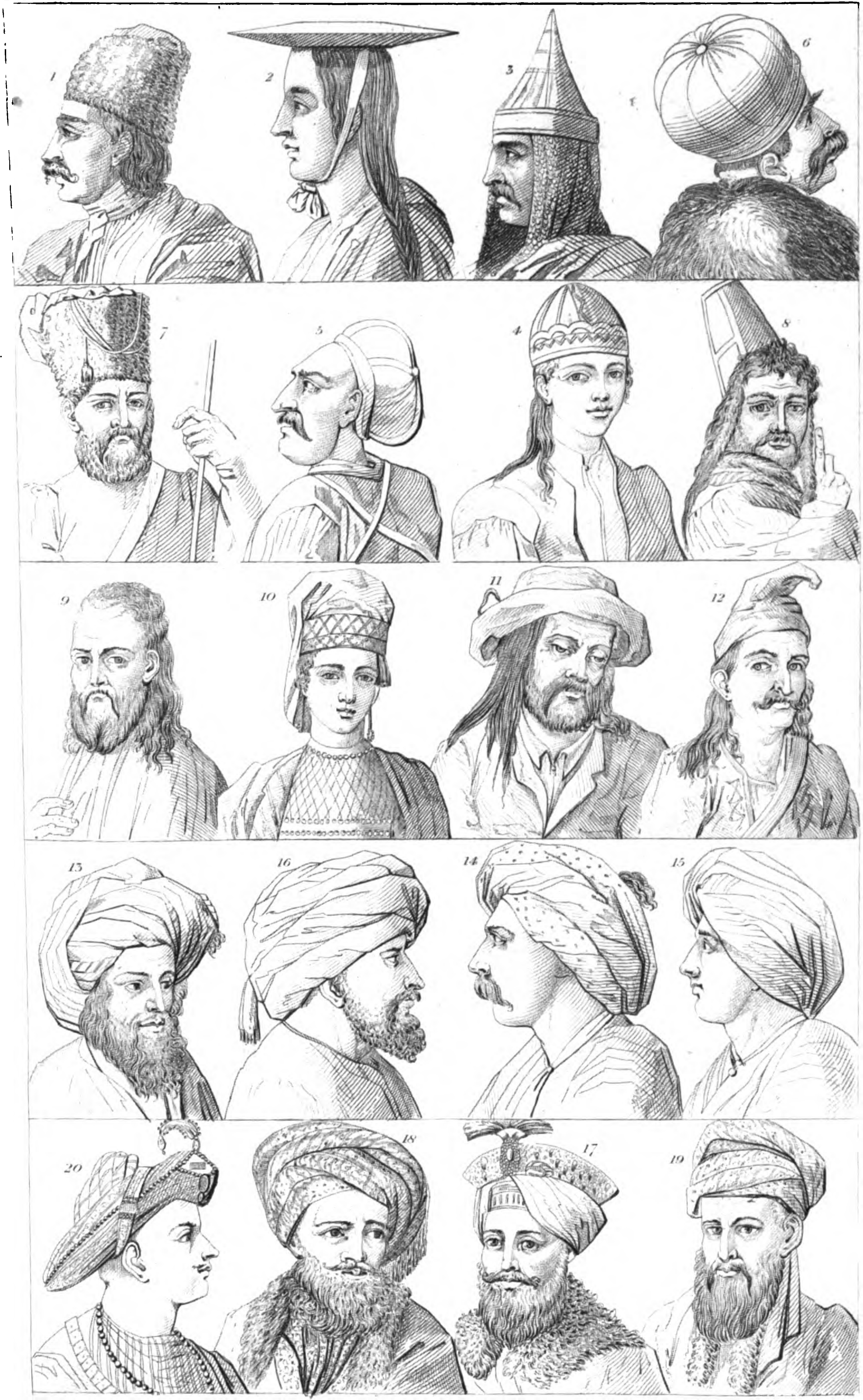
Fusus *contrarius*

Engd by J. W. Lowry

BLACKIE & SON GLASGOW, EDINBURGH & LONDON.

MAN.

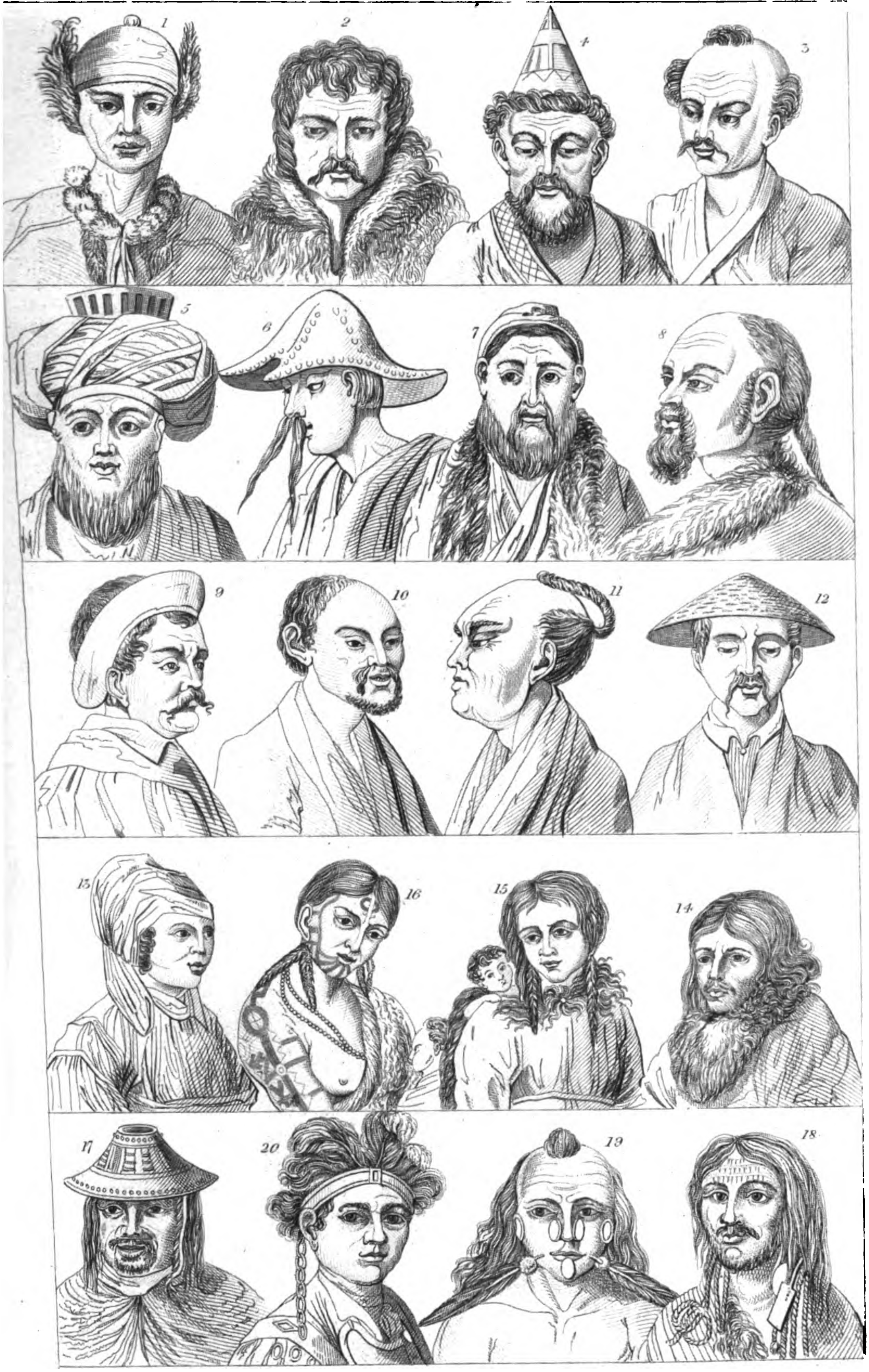
XLVII. PLATE LXXIV.



[illegible]

Published by Blackie & Son Glasgow.

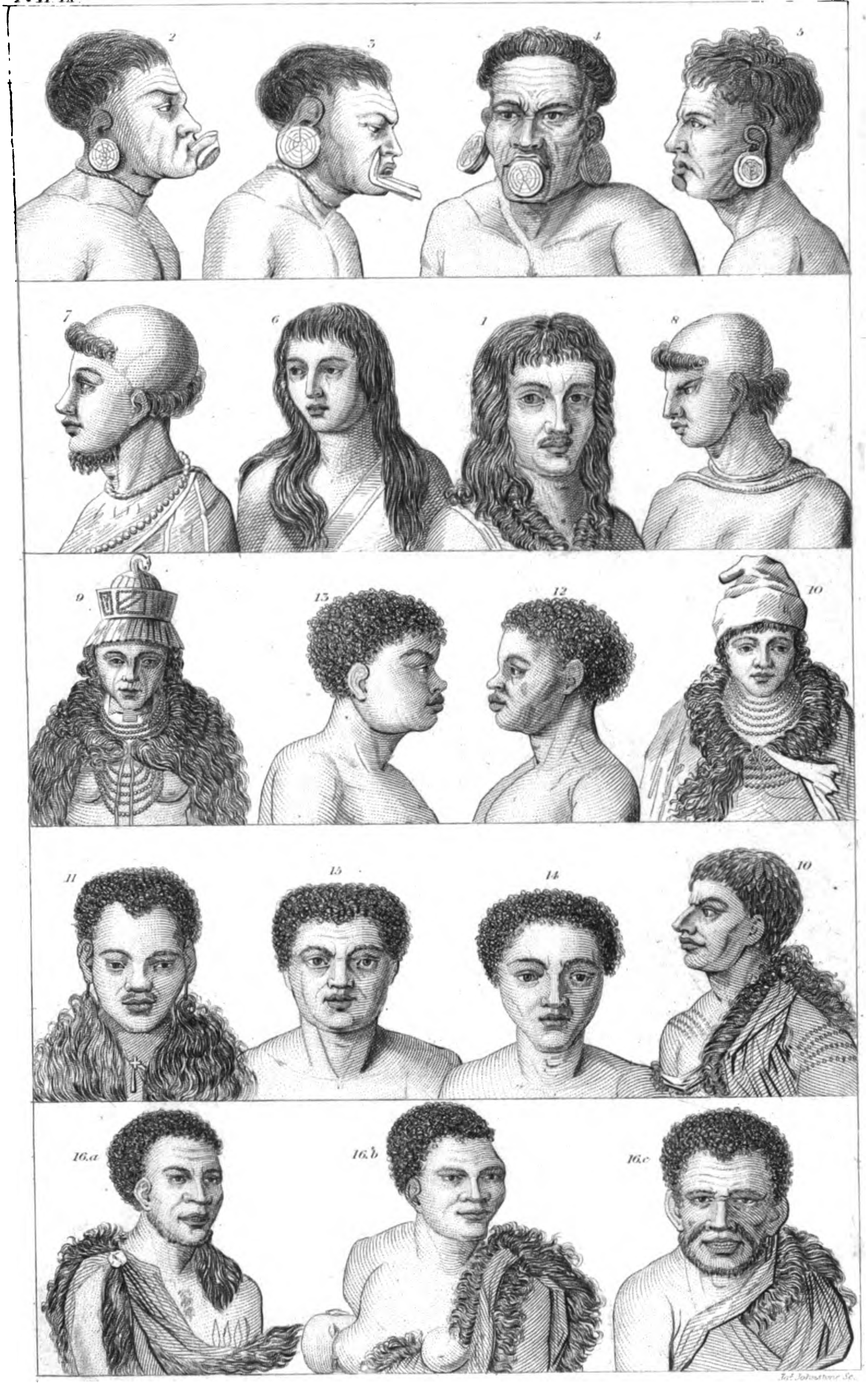
MAN



Published by Blackie & Son Glasgow.

MAN

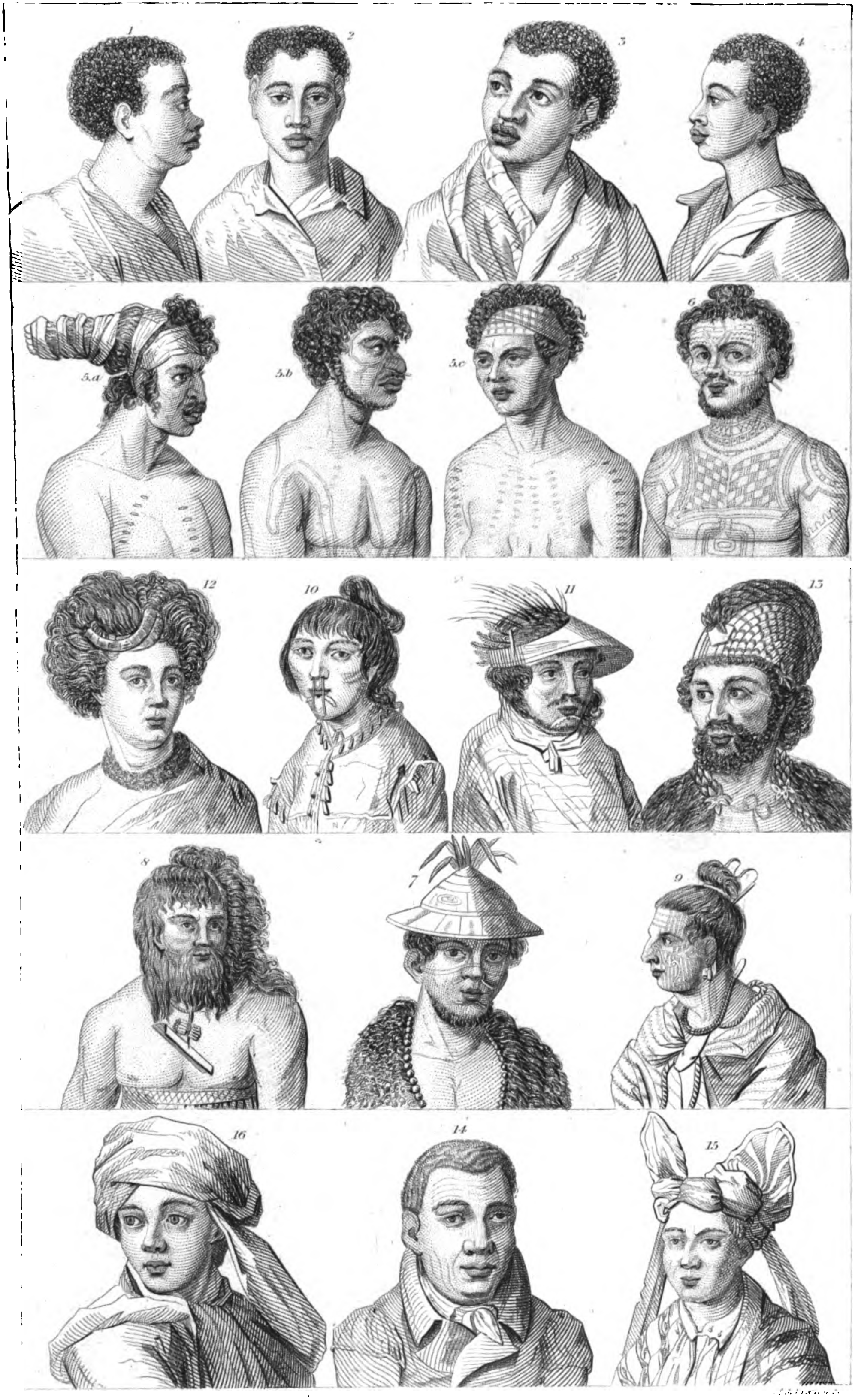
VII. IX. PLATE LXXVI.



Jas. Johnstone Sc.

Published by Blackie & Son, Glasgow.

MAN

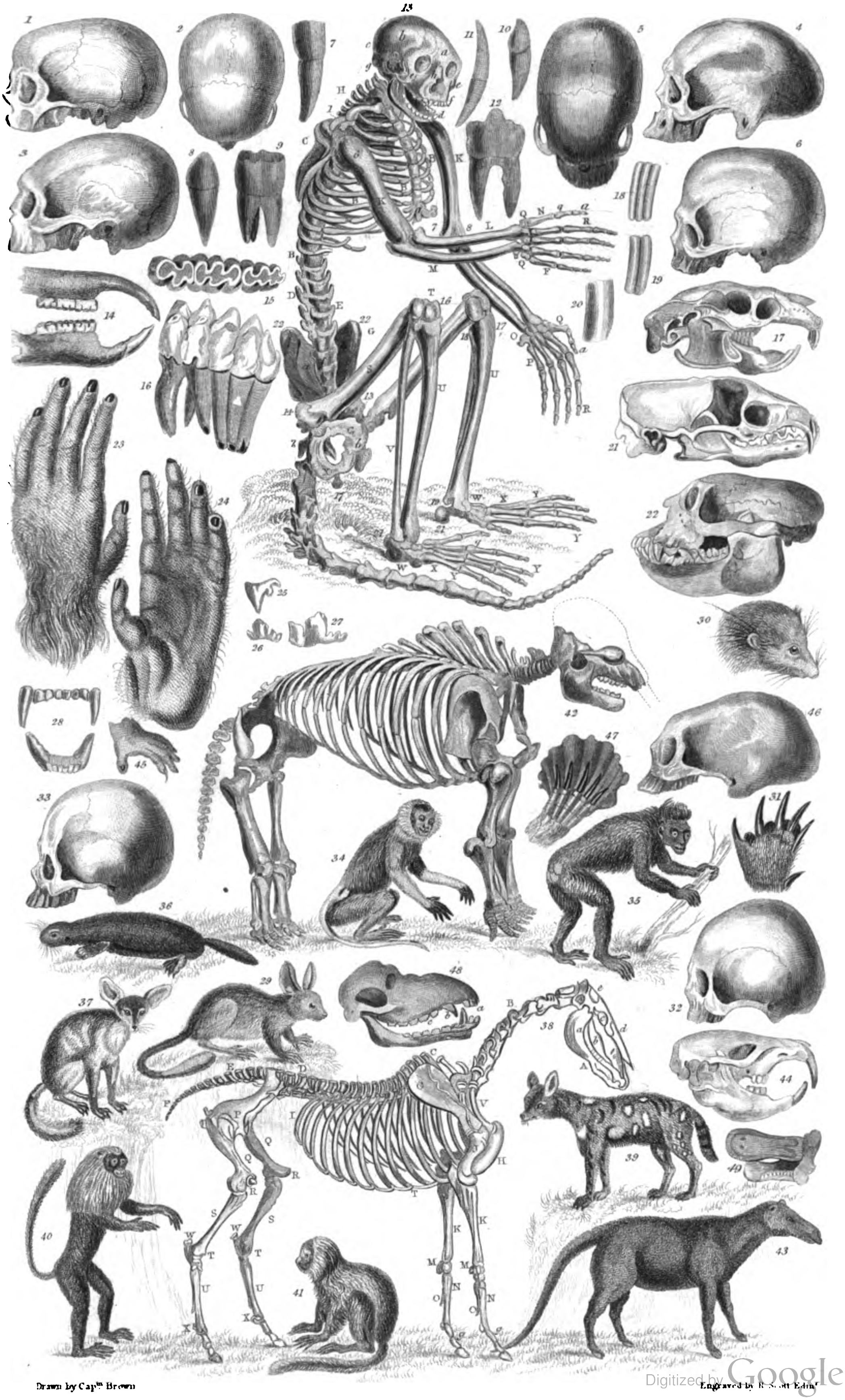


Published by Blackie & Son, Glasgow.

N. II. n

MAMMALIA

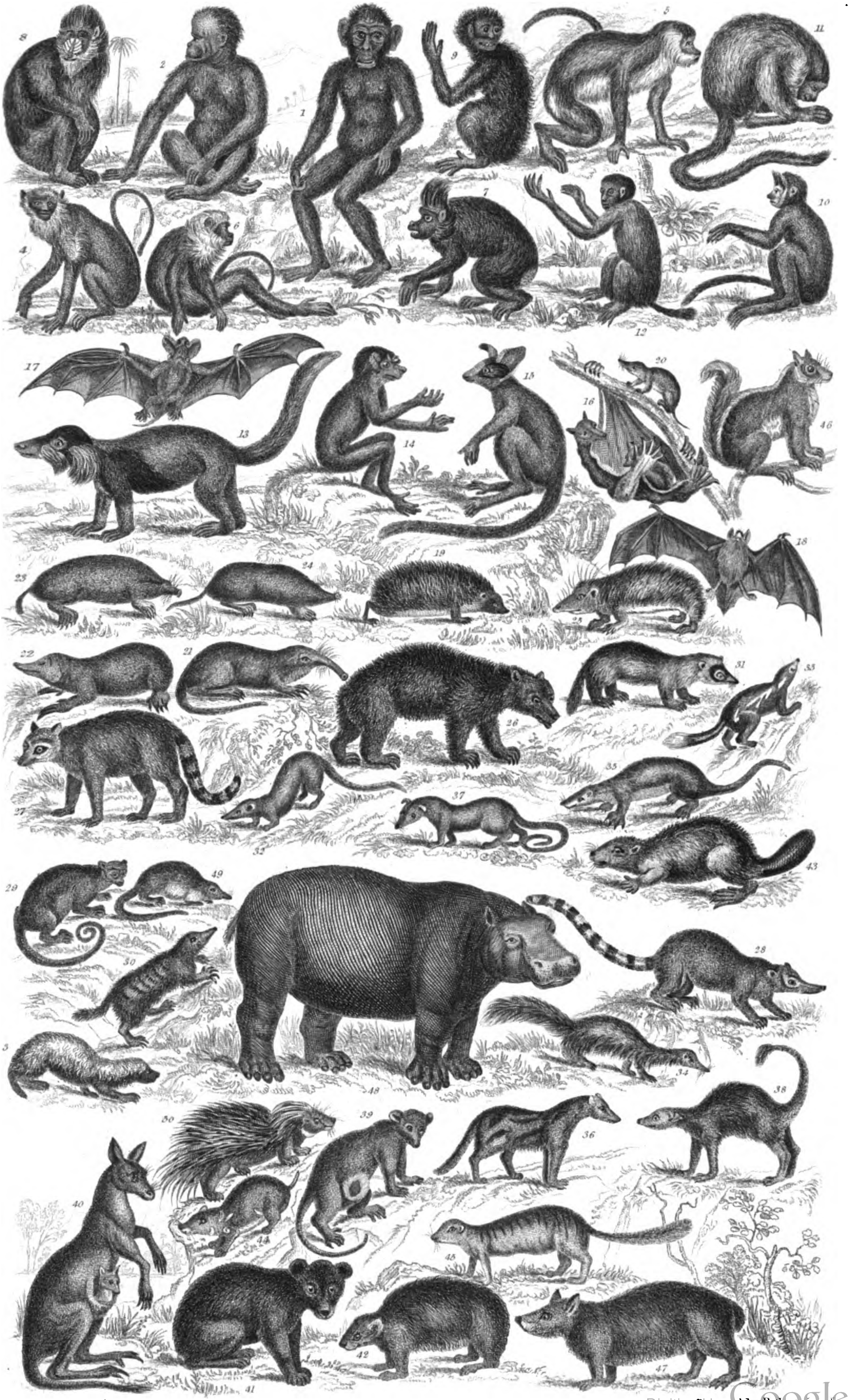
LXX



Drawn by Capⁿ Brown

Engraved by R. Scott Edinʳ

MAMMALIA

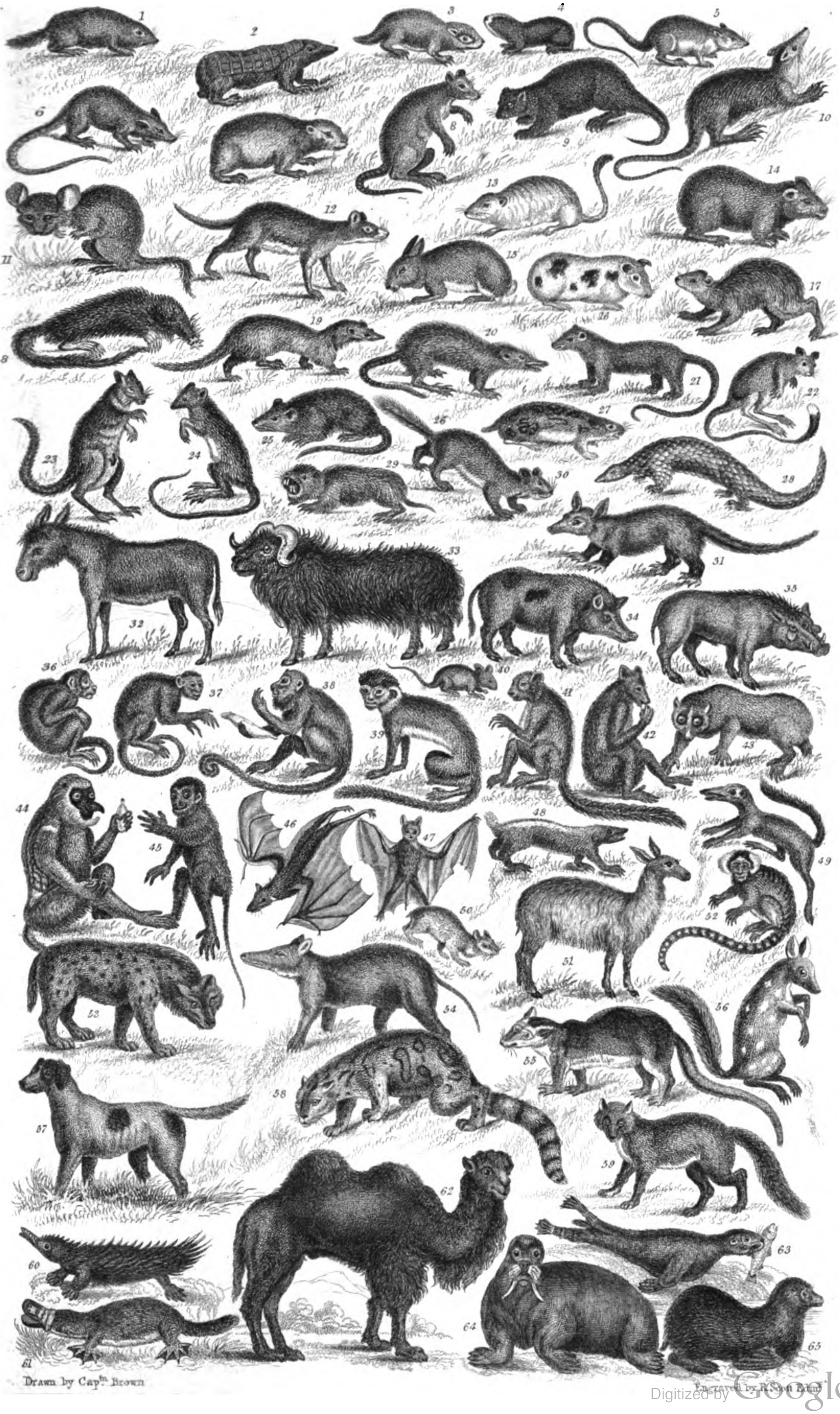


Drawn by Capt^n Brown Engraved by R. Scott Edin^r

N.II.13.

MAMMALIA

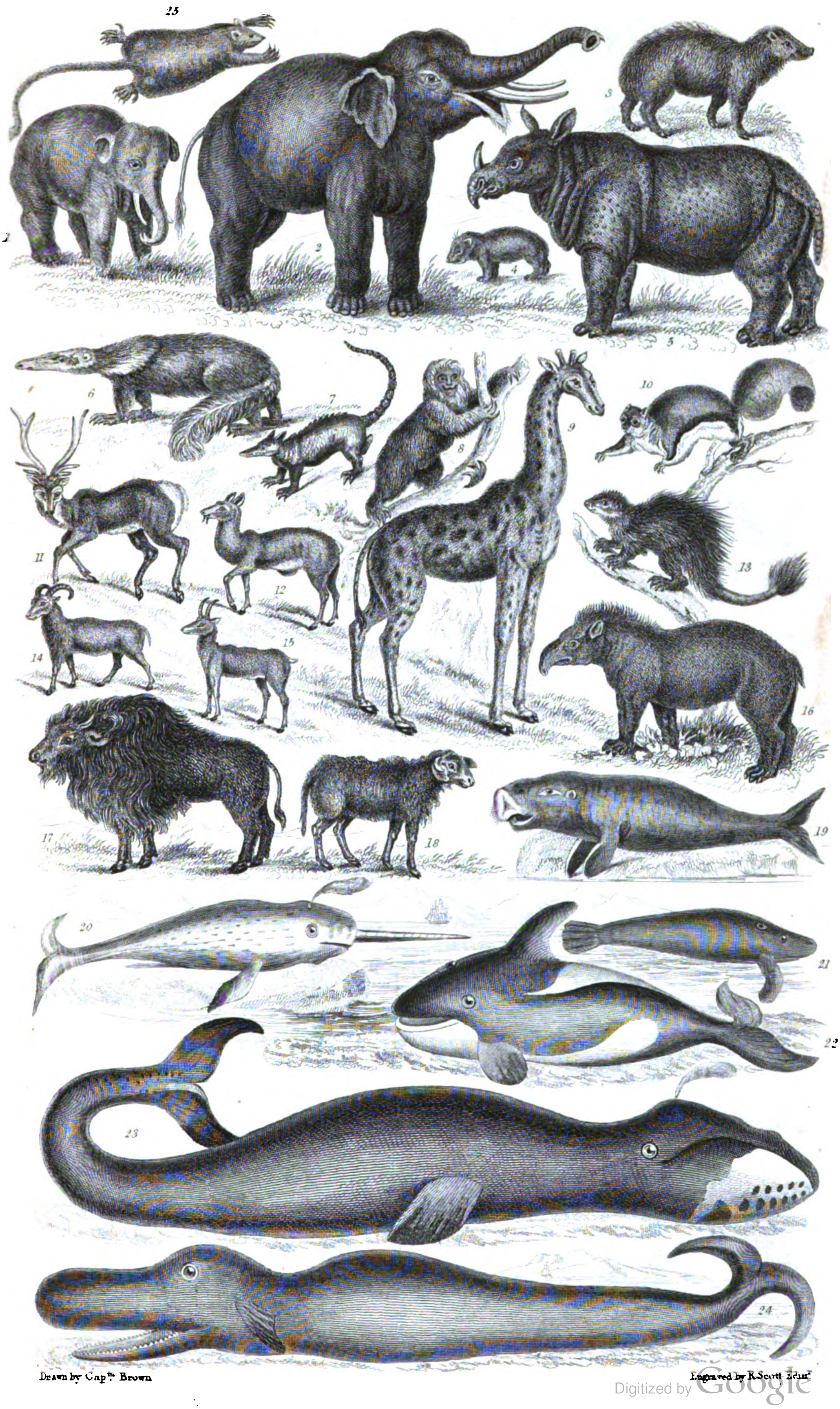
PLATE LXVI.



Drawn by Captn. Brown

Engraved by R. Scott Edinr.

MAMMALIA



Drawn by Capt^n. Brown

Engraved by R. Scott Edin^r.

A
HISTORY OF THE EARTH.

CHAP. I.

A SKETCH OF THE UNIVERSE.

THE world may be considered as one vast mansion, where man has been admitted to enjoy, to admire, and to be grateful. The first desires of savage nature are merely to gratify the importunities of sensual appetite, and to neglect the contemplation of things, barely satisfied with their enjoyment: the beauties of nature, and all the wonders of creation, have but little charms for a being taken up in obviating the wants of the day, and anxious for precarious subsistence.

Philosophers, therefore, who have testified such surprise at the want of curiosity in the ignorant, seem not to consider that they are usually employed in making provisions of a more important nature; in providing rather for the necessities than the amusements of life. It is not till our more pressing wants are sufficiently supplied, that we can attend to the calls of curiosity; so that in every age scientific refinement has been the latest effort of human industry.

But human curiosity, though at first slowly excited, being at last possessed of leisure for indulging its propensity, becomes one of the greatest amusements of life, and gives higher satisfactions than what even the senses can afford. A man of this disposition turns all nature into a magnificent theatre, replete with objects of wonder and surprise, and fitted up chiefly for his happiness and entertainment: he industriously examines all things, from the minutest insect to the most finished animal; and, when his limited organs can no longer make the disquisition, he sends out his imagination upon new inquiries.

Nothing, therefore, can be more august and striking than the idea which his reason, aided by his imagination, furnishes of the universe around him. Astronomers tell us, that this earth which we inhabit, forms but a very minute part in that great assemblage of bodies of which the world is composed. It is a million of times less than the sun, by which it is enlightened. The planets also, which, like it, are subordinate to the sun's influence, exceed the earth a

---

The early history of Astronomy refers us to a remote period, when the worship of the true God had been altogether lost or become obscured, and when men began to appropriate divine honours and worship to the sun and moon, and to the host of heaven. Of all forms of idolatry, this was, in its first stages, the purest and the most intellectual. But error rapidly begets error, and it was not long before the human imagination superinduced on the simpler faith the wildest superstitions. The various bodies of the universe came to be regarded as intelligent and physical agents, by which the weal or woe, not of states and kingdoms only, but of individual men was determined; and hence the configurations of the heavens, and the relations of the luminaries at the instant of a man's birth, were watched and recorded, and from them all the circumstances of his life were predicted. This was the astrological era; and although the movements of the heavens were sedulously noted and registered, and that under the advantage of the cloudless sky of the East, the result, in an astronomical point of view, amounted only to a careful investigation of apparent motions. But the mere record of apparent movement and phenomena had its use for after observers; and the labours of the astrologer, like those of the alchemist, rendered valuable assistance to the cause of truth.

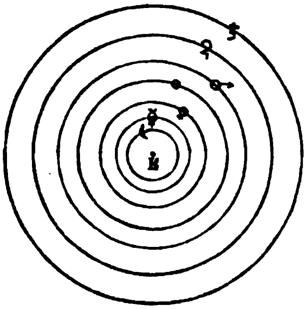
Different systems have obtained in different ages of the world. The first, naturally enough, explained the motions of the heavenly bodies according to the evidence of the senses. Claudius Ptolemy, a famous mathematician and astronomer of Pelusium in Egypt, in the second century after Christ, taught that the earth was the immoveable centre of the universe, round which the sun, planets, and stars revolved, in the following order: nearest to the earth, was the Moon; then followed Mercury, Venus, the Sun, Mars, Jupiter, and Saturn; these were succeeded by the *firmament*, or sphere of fixed stars, two other spheres called *crystalline*, and an outer sphere named the *primum mobile*, or first motion, which last was again circumscribed by the *cælum empyreum*, of a cubic form, wherein the souls of the blessed were supposed to reside after death.

thousand times in magnitude. These, which were at first supposed to wander in the heavens without any fixed path, and that took their name from their apparent deviations, have long been found to perform their circuits with great exactness and strict regularity. They have been discovered as forming, with our earth, a system of bodies circulating round the sun, all obedient to one law, and impelled by one common influence.

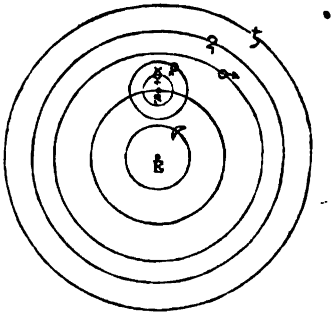
Modern philosophy has taught us to believe, that, when the great Author of nature began the work of creation, he chose to operate by second causes; and that, suspending

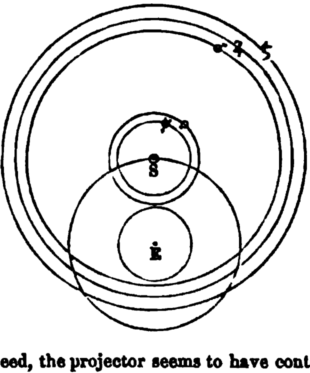
---

This system obtained considerable credit from its agreement with the apparent motion of the heavenly bodies; but it gradually fell into neglect as additional observations were made and new facts elicited, since it proved utterly incapable of explaining great part of the phenomena presented to the eye of the astronomer. A strong argument against the truth of this system arose also from a consideration of the velocity with which the heavenly bodies must, on this hypothesis, revolve in their spheres. It was necessary that in every twenty-four hours the whole machinery of the universe should make an entire revolution round the earth from east to west,—a world-destroying motion which numbers are unequal to express, and of which the human imagination cannot possibly form an idea.

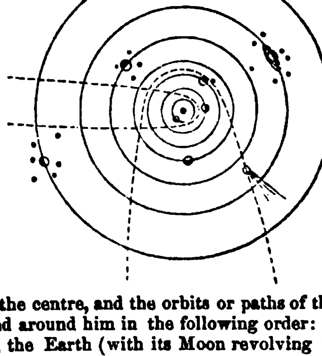


Another system, named the *Egyptian*, the rise of which cannot be clearly ascertained, represented Mercury and Venus revolving round the sun, and following that luminary in its path round the earth. The superior planets were supposed, as in the Ptolemaic system, to move around the earth as their common centre. The *Tychonic system*, which in order of time was proposed subsequently to the Copernican theory, originated with Tycho Brahe, a Danish nobleman, who lived in the latter part of the sixteenth century. "This philosopher, though he approved of the Copernican system, yet could he not reconcile himself to the motion of the earth; and being, on the other hand, convinced that the Ptolemaic scheme in part could not be true, he contrived one different from either. It will be noticed that according to this hypothesis the superior and inferior planets have the sun for their centre, and are carried with the sun around the earth. This system obtained no great credit; for it failed to remove the difficulties connected with the Ptolemaic scheme, and at the same time introduced such irregularity and diversity of motion as could not be rationally accounted for. Indeed, the projector seems to have contemplated little more in the formation of his hypothesis than a perfect coincidence with the *literal* interpretation of various passages in Scripture asserting the immobility of the earth.





The *Copernican System* was proposed by Nicholas Copernicus, a canon of Thorn in Prussia, A.D. 1473. The simple explanation which it affords of the motions and phenomena of the heavenly bodies, procured for it the assent of the principal astronomers. In this system the sun is immoveable, and the earth and other planetary bodies revolve round it in elliptic paths, at different distances and with different velocities. In place of that inconceivable motion of the spheres required by the Ptolemaic theory to explain the diurnal phenomena, we have the *real* motion of the earth on its axis from west to east, producing the *apparent* daily motion of the heavens from east to west. The annual phenomena also of all the bodies in the system are explained by this theory as the result of one harmonious principle. Referring to the annexed cut, we see the sun in the centre, and the orbits or paths of the planets disposed around him in the following order: Mercury, Venus, the Earth (with its Moon revolving round it), Mars, Jupiter, and Saturn. Other bodies seen in this diagram will be referred to when we come to speak of



the constant exertion of his power, he endued matter with a quality, by which the universal economy of nature might be continued without his immediate assistance. This quality is called *attraction;* a sort of approximating influence, which all bodies, whether terrestrial or celestial, are found to possess; and which in all increases as the quantity of matter in each increases. The sun, by far the greatest body in our system, is, of consequence, possessed of much the greatest share of this attracting power; and all the planets, of which our earth is one, are, of course, entirely subject to its superior influ-

---

the Newtonian system. The Copernican scheme included only the earth and moon, and the five planets just named; for Uranus and Neptune are recent discoveries, and the satellites of Jupiter and Saturn were not observed till the powers of the telescope had been much increased, many years after the time in which Copernicus flourished. Of comets also nothing was known beyond the fact of their occasional appearance.

From the unsatisfactory nature of the systems proposed by the astronomers of the early ages, the science languished in its infancy, and lay in oblivion for ages, till it was at length revived by Cardinal Cusa, and established by Copernicus. But no sooner had a rational theory been promulgated, than a host of talented and learned men rose up to strengthen its principles and enlarge its discoveries. Contemporary with, or immediately succeeding to Copernicus, were Rheticus, Rothmannus, Lansbergius, Schikardus, Kepler, Galileo. After these appeared Gassendus, Hevelius, Ricciolus, Cassini, Huygens, Flamsteed, Halley, Gregory, Keil, and others; these great men succeeded in demonstrating and establishing many of the fundamental laws of astronomical science, and added a number of splendid discoveries in the ample field which it opened to their view. But one was about to appear, gifted with giant intellect and an intuitive perception of cause and effect, before whose irrevocable theories the aggregate philosophy of past ages should stand abashed. In unobtrusive boyhood the master-spirit of all time passed on, distinguished only by the superficial eye for dulness of exterior, an attachment to calculations, and a predilection for projecting dials on walls of favourable aspect, in his leisure hours. Time waned and the boy became a man. There was a stir in the philosophical world—something had been done which for ages had baffled and defeated every effort of human ingenuity and science. NEWTON had discovered and propounded the laws of the universe!

The Newtonian system is shown in the cut to which we referred in illustration of the Copernican system. It will however be necessary to bear in mind that the planets Uranus and Neptune were not known to Newton. This system includes the primary planets, Mercury, Venus, the Earth, Mars, Jupiter, Saturn; and the secondary planets, or satellites, connected with them, viz., one with the earth (the Moon), four with Jupiter, and five with Saturn; the sixth, seventh, and eighth satellites of this last-named planet being recent discoveries. The primary planets move round their common centre, the sun; and the satellites of each planet revolve around it in orbits, and are also carried with it in its motion round the sun. The Newtonian system embraces likewise the orbits of several comets.

To former theories of the universe the term *hypothesis* is most applicable; but the system of Newton cannot be considered hypothetical, since it explains, on comprehensive principles all the phenomena of the heavens, and exhibits a perspicuous harmony in its conclusions.

The foundation of the Newtonian theory is the attraction of gravitation, that force which causes all bodies near the earth to tend towards its centre; and which prevents the earth's rapid motion round the axis from throwing off the bodies that lie on its surface, as it certainly would do, were they not retained by some very potent principle. This force, by which a body tends to the centre of the earth, is commonly called its weight, and the weights of bodies at equal distances from the centre are always proportional to the quantities of solid matter they contain. This attractive force of the earth is found not to act equally on bodies at all distances from its centre. Sir Isaac Newton has demonstrated that this force above the surface of the earth, decreases in the same proportion that the square of the distance from the centre increases; that is, the force with which the earth acts on bodies to put them in motion, at different distances above the surface, is reciprocally as the squares of their distances from the centre. So that if a body at the surface of the earth (whose distance from the centre is about 4000 miles), weighs four pounds, and by the force of gravity falls through 16 feet in a second of time; it will, at double that distance, weigh but one pound, and fall through but 4 feet in one second of time. He has likewise proved that the gravity of a body at any place below the surface of the earth, is directly proportional to its distance from the centre; that is, a body which at the surface weighs one pound, will within the earth, at the distance of 2000 miles from the centre, weigh but half a pound, and at the distance of 1000 miles, but a quarter of a pound, and so on, till at the centre it loses all its weight. Though, strictly speaking, the accelerating force of gravity decreases in the manner above mentioned, yet where the distances from the surface are inconsiderable with respect to the earth's radius (as are all the distances to which we can project bodies), the force of gravity may be looked upon as equal at all these distances. And on this supposition are founded the reasonings of Galileo, Torricellius, Huygens, and other naturalists, concerning the descent of heavy bodies, and the several theorems which relate to the acceleration of falling bodies, the spaces described by them, the times of the fall, and the velocities thereby acquired.

The property of gravitation is not confined to the matter of which our earth is formed, but is found to be a general property of all bodies that come any way under our observation. Sir Isaac Newton has demonstrated that the moon gravitates towards the earth, and is retained in her orbit merely by that force. And since the revolution of the moons round Jupiter and Saturn, and of the primary planets round the sun, are phenomena or effects of the same kind with the revolution of our moon round the earth, he concludes, by the second rule of philosophizing, that all these effects must proceed from like causes, and therefore that the moons of Jupiter and Saturn gravitate towards their primaries, and that all the primary planets gravitate towards the sun. He has shown also, that if one body attracts another with any force, with the same force does that other body attract it; so that the earth must gravitate towards the moon, the sun towards the planets, and they all towards each other. He has proved likewise that the attractive forces of these great bodies act according to one universal and invariable law, which is, that every two of them attract each other with forces that are *directly* as their quantities of matter and *inversely* as the square of the distance between their centres.

The two forces which govern the motions of the planetary bodies are named *centripetal* and *centrifugal.* The *centripetal force* is the attraction of gravitation; the *centrifugal force* is motion itself. If a body is ence. Were this power, therefore, left uncontrolled by any other, the sun must quickly have attracted all the bodies of our celestial system to itself; but it is equally counteracted by another power of equal efficacy; namely, a progressive force, which each planet received when it was impelled forward by the divine Architect, upon its first formation. The heavenly bodies of our system being thus acted upon by two opposing powers; namely, by that of *attraction*, which draws them towards the sun; and that of *impulsion*, which drives them straight forward into the great void of space; they pursue a track be-

---

suspended at the end of a string, moveable about a point, or pin, as a centre, and in that position it receives an impulse or blow in a horizontal direction, it will be thereby compelled to describe a circle about the central pin: while the circular motion continues, the body will have a continual endeavour to recede or fly off from the centre, which is called its *centrifugal force*, and arises from the horizontal impetus; with this force it acts upon the fixed centre pin, and that, by its immobility, reacts with an equal force on the body by means of the string, and solicits it towards the centre of motion, whence it is called the *centripetal force;* and when we speak of them indefinitely, they are called the *central forces* of the revolving body. It is important to understand the nature of this kind of motion, since by it all the machinery of the planetary system is governed, as will be easy to understand, if for the revolving body, we substitute a planet; for the centre we place the sun; for the centripetal force, or string, its power of attraction; and for the projectile force, the almighty power of God in the first creation of things. The theory of circular motion, as applying to the celestial bodies, is comprised in the following proposition:—1. The *projectile* force is infinitely greater than the *centrifugal* force. 2. The central force is proportional to the quantity of matter in the revolving body, all other things being equal. 3. If two equal bodies describe unequal circles in equal times, the central forces will be as the distances from the centre. 4. If equal bodies describe unequal circles with equal celerities, the central forces will be inversely as the distances. 5. If equal bodies describe equal circles, the central forces will be as the squares of the celerities. 6. If equal bodies describing unequal circles, have their central forces equal, their periodical times will be as the square root of the distances. 7. If equal bodies describe unequal circles with equal celerities, the periodical times will be as the distances directly. 8. Therefore, the squares of the periodical times are proportional to the cubes of the distances, when neither the periodical times nor the celerities are given. And, 9. In that case, the central forces are as the squares of the distances inversely.

The *Sun* is the centre of our system, and the source of light and heat to the planetary bodies revolving round it. Its form is ascertained to be that of a globe, whose diameter is 882,000 miles, or upwards of 111 times that of the earth. Like the planets, the sun performs a rotation on its axis, which it completes in 25 days, 7 hours, and 25 minutes. It makes also a revolution around the centre of gravity of the system, which centre lies within its body, and hence the movement is similar to that of a circular disk rotating on an eccentric axis.

One of the first results of the invention of the telescope, was the discovery of numerous dark spots upon the sun's disk. In endeavouring to discover to what causes these marks are to be ascribed, observers have ascertained some facts regarding the physical constitution of the sun itself. When a spot is watched for a considerable time, it is found to undergo a gradual change in its form and magnitude. From a comparatively small object, it increases in dimensions until it attains a certain limit, when it begins to decrease, continuing to do so until lost sight of. The period during which a solar spot passes through these phases varies exceedingly; some are only visible for a few days, while others last for months. At one time these marks upon the sun's disk were supposed to be occasioned by *scoriæ*, or masses of incombustible matter floating on the surface of the sun, but as this explanation could not account for many of the phenomena which they were observed to exhibit, it was dismissed. A minute examination of the various phases which a spot passes through as it is carried to the edge of the sun's disk by the solar rotation, has forced upon observers the conclusion, that it can be caused only by conical depression in the luminous coating of the sun, the dark part being a portion of the non-luminous matter. As we have already shown that the solar spots are continually undergoing changes in their dimensions, it is evident that if they are due to depressions in the surface of the sun, that surface cannot be composed of solid matter. This fact, combined with others, has led to the general adoption of the supposition originally advanced by Sir William Herschel, that the solid portion of the sun is surrounded by two atmospheres, that which is next the nucleus being non-luminous, and that it is from the superior one only that light and heat are emitted. Whether they be gaseous or not, the existence of two distinct strata cannot be doubted; and that the upper one is gaseous is evident, since the rays issuing from the sun in an oblique direction show none of those evidences of polarization which the oblique rays emitted by a solid or liquid body invariably exhibit. Thus the diameter of the sun is not that of its solid nucleus, but of the nucleus together with its atmospheric coatings, and this circumstance explains how the mean density of the sun is five times less than that of the earth, that is, that bulk for bulk, the earth is five times heavier than the sun.

Nothing definite is known regarding the physical cause of the sun's heat, but it seems very improbable that it can be the result of combustion, or of any other agency involving extensive chemical changes alone. It has been suggested that the solar heat and light may possibly be produced by friction or the action of electric currents. According to this latter supposition, the upper stratum of the sun would be a mass of electric flame.

Mercury, from its proximity to the sun, seldom comes within the sphere of our observation. Its distance from that luminary is 36,770,000 miles: it performs its annual revolution in 87 days, 23 hours, 16 minutes: the period of its diurnal rotation is not known. Its diameter is ascertained to be 2950 miles.

It has of late been a subject of discussion whether this is the planet nearest to the sun. This question was first brought before the public in January, 1860, when M. le Verrier communicated to the Academy of Sciences the results of his observation of twenty-one transits of Mercury across the sun's disk, from which he deduced a variation of 28 seconds in the secular motion of the perihelion of that planet. To account for this irregularity, Le Verrier assumed the existence of a small planet, or a ring of smaller bodies, between Mercury and the sun. At that instant the scientific world was startled by the announcement, that a village doctor, M. Lescarbault of Orgeres, in the arrondissement of Chateaudun, had actually seen the intra-mercurial planet, and observed its transit across the sun, Le Verrier visited the discoverer, and found him to be an amateur astronomer, working with comparatively tween these contrary directions; and each, like a stone whirled about in a sling, obeying two opposite forces, circulates round its great centre of heat and motion.

In this manner, therefore, is the harmony of our planetary system preserved. The sun, in the midst, gives heat, and light, and circular motion, to the planets which surround it; Mercury, Venus, the Earth, Mars, Jupiter, and Saturn, perform their constant circuits at different distances, each taking up a time to complete its revolutions proportioned to the greatness of the circle which it is to describe. The lesser planets also, which are

---

rude instruments, and under great disadvantages. After severe questioning, and close investigation of M. Lescarbault's details, he was convinced that the latter had not attempted an imposition, but had made a faithful report. An opponent to the new theory appeared in M. Liais, another French astronomer of high repute, who denied both the discovery and Le Verrier's deductions in relation to Mercury's motion. The question is still unsettled, and in all probability will long remain so. There is a strong argument against the discovery, in the fact that nothing has transpired since the announcement to confirm it, although the favourable conditions of a total eclipse occurred on 18th July, 1860, and offered singular advantages for observing a small bright planet in the neighbourhood of the sun. We fear that the discovery will ultimately prove to be only another instance of sanguine belief founded on error. M. Lescarbault, it is likely, having fatigued his eye at the time of his observation, transferred a small spectral mote on the retina to the sun's disk, and involuntarily carried it across in a regular transit.

Venus is to appearance the brightest and largest of the planets. Its distance from the sun is 68,750,000 miles: the annual revolution is completed in 224 days, 16 hours, 49 minutes: the diurnal rotation on its axis is performed in 23 hours, 15 minutes: the diameter of the planet is 7760 miles. Venus is familiar as the alternate evening and morning star. Her moon-like phases are very interesting under the telescope, and it is worthy of remark, that at the period of her greatest lustre the illuminated portion of her surface is a thin crescent.

The *Earth* is placed at the distance of 94,736,800 miles from the sun: revolves round him in 365 days, 6 hours, 9 minutes, 9·6 seconds: makes a diurnal rotation in 24 hours: its diameter is 7920 miles.

The Moon.—The earth is accompanied in its annual progress by the moon, which revolves round it in 29 days, 12 hours, 14 minutes. Its diameter is 2153 miles, and its distance from the earth 237,630 miles. As the moon always presents the same surface to the earth, it must perform its orbital revolution, and its rotation on its axis, in the same period. This peculiar motion appears to be a characteristic of all the satellites in the solar system. The duration of a lunar day and night of course corresponds to the period of the moon's rotation on its axis. The phases which the moon exhibits to an observer on the earth are due to the greater or less illumination of the hemisphere presented towards us; when it is not full moon, portions of the surface invisible to us are exposed to the influence of the sun's rays. From its proximity to the earth, observers have been able to obtain much interesting information regarding the structure and physical condition of the moon. The entire surface of its visible hemisphere is covered with mountain ranges, many of which contain peaks of stupendous height. Their sides are generally precipitous, and in some instances they are found to rise almost vertically from the base to the summit of the mountain. Inclosed by high ridges, there are observed large circular areas called bulwark-plains. These inclosures vary in diameter from 40 to 120 miles. They are generally found to contain smaller conical mountains, though sometimes the surface seems to be level, while in other cases it is slightly depressed, and the base of the inclosed area appears of concave form. There are likewise discovered on the moon's surface other circular inclosures on a smaller scale than the bulwark-plains. These are ring-mountains. Some of them form portions of the ridge which incloses a bulwark-plain, while others stand alone. The inner side of a ring-mountain is always steep, and in the inclosed area there is frequently observed a central elevation. Tycho, the most remarkable object of this description, can be seen with the naked eye during full moon. The height of this mountain above the level of the inclosed space is 16,000 feet, and above that of the external surface 12,000 feet: the diameter of the ring is forty-four miles. Smaller formations of similar structure are observed over all the visible hemisphere of the moon, which, from their volcanic character, have been supposed by some to be craters. We are not justified in accepting this conclusion until further evidence is adduced in support of it. When Tycho, Gassendi, and other large ring-mountains were first seen through telescopes of inferior power, they were declared to be volcanoes, but subsequent examination of the lunar surface with higher optical powers has demonstrated the fallacy of that theory, for it has shown how little real resemblance exists betwixt one of them and a terrestrial volcano.

Various tests have been employed with the view of ascertaining whether the moon has an atmosphere. The result of these investigations has gone far to demonstrate that the moon has no gaseous coating of any description. From this cause the benefits of the sun's light and heat will not be experienced on the surface of the moon to the same extent as they are on the earth. In a region destitute of atmosphere, the cold would probably be more intense than that which is felt on any portion of our globe.

Mars is distant from the sun 144,780,000 miles: makes its annual course in 686 days, 23 hours: revolves on its axis in 24 hours, 37 minutes, 10 seconds. Its diameter measures 4085 miles. Numerous white spots have been observed near the poles of this planet, which are supposed to indicate the presence of snow which has accumulated in these regions.

The *Planetoids* are a number of small planets, whose orbits lie between those of Mars and Jupiter. With the exception of four, which were first observed in the beginning of the present century, they have all been discovered since 1845. At the present time the existence of a large number of these bodies is known, and we have good reason to believe that the search for small planets, which is still pursued both by professional and amateur observers, will result in further discoveries. Some particulars regarding the dimensions and motions of a few of the planetoids have been ascertained; but we deem it needless to introduce them here, as they can be of little interest in a popular view of astronomy.

Jupiter.—This majestic planet, whose diameter is 88,640 miles, is situated at the distance of 494,000,000 miles from the sun, round which it revolves in 4332 days, 14 hours, 24 minutes. Its rotation on its axis is performed in 9 hours, 55 minutes. Permanent spots exist on the surface of this planet, and belt-like appearances are observed, which undergo considerable change. These phenomena have been attributed to the motions of masses of clouds floating in the planet's atmosphere. Jupiter is attended by four moons or satellites, which revolve round it as their primary. These bodies were attendants upon some of the greater, are subject to the same laws; they circulate with the same exactness; and are, in the same manner, influenced by their respective centres of motion.

Besides those bodies which make a part of our peculiar system, and which may be said to reside within its great circumference, there are others that frequently come among us, from the most distant tracts of space, and that seem like dangerous intruders upon the beautiful simplicity of nature. These are comets, whose appearance was once so terrible to mankind; and the theory of which is

---

discovered by Galileo, three on the night of the 7th January, 1610, and the fourth on the 13th of the same month.

Saturn is distant from the sun 906,000,000 miles: performs its orbital revolution in 10,759 days, 5 hours, 14 minutes: rotates on its axis in 10 hours, 29 minutes. Its diameter measures 75,000 miles. Eight moons attend this planet; the eighth was discovered by Huygens in 1655, the third, fourth, fifth, and sixth, by Cassini, between the years 1671 and 1684; the first and second, by Herschel, in August, 1789: and the seventh, in September, 1848, by Mr. Lassell of Liverpool, and Professor Bond, of Cambridge, United States, the honour of the discovery belonging equally to both of these gentlemen, each having observed it on the same evening. Saturn is likewise furnished with a beautiful ring, entirely detached from its surface, and which, in its different positions, presents a variety of interesting phenomena. It has been ascertained to consist of at least three separate concentric rings. This curious appendage of the planet was first discovered by Huygens in 1659, though Galileo, in 1610, had observed, with his comparatively imperfect glasses, that the form of Saturn differed greatly from that of the other planets.

Uranus was discovered by Sir William Herschel on 13th March, 1781. It is 1,822,000,000 miles distant from the sun, round which it revolves in 30,686 days. Its diameter measures 34,526 miles. When Herschel discovered this planet he fancied that he observed six satellites attending it. This discovery has been absolutely confirmed, only as far as it relates to the second and fourth of these bodies; the fifth and sixth have never been seen since Herschel announced his observation of them; and though it has been stated that the other two have been re-discovered, there is not sufficient evidence to convince us of the existence of more than two satellites of Uranus.

Neptune.—Before the discovery of this planet, certain irregularities which could not be accounted for had been observed in the motions of Uranus. At first they were ascribed to errors in observation, but after a time this opinion was discarded, as it was found that the deviations of the planet from its computed orbit followed an apparently well-defined rule. By the attraction of gravitation each planet exercises a perceptible influence on the movements of those in its more immediate vicinity. In calculating the orbit of Uranus the effects of all known forces of this nature having been considered, the only conclusion which could be arrived at was, that these disturbances were the results of the action of an unknown planet. Hitherto planetary discoveries had always been results of actual observations: but in the present instance observers failed to detect any trace of a planet, of whose existence there could not be a doubt. The different positions of portions of the actual and computed paths of Uranus had been ascertained; and it occurred at about the same time to two astronomers, M. le Verrier of Paris, and Mr. J. C. Adams of Cambridge, to calculate from the scanty data thus supplied, the position and orbit of the unknown body. The solution of a problem of this description presents difficulties which can only be appreciated by those who have made the higher mathematics their study. But in spite of the intricacy of the question, M. le Verrier and Mr. Adams, unknown to one another, continued and concluded their investigations, each believing that he stood alone in his arduous attempt. The merit of the discovery of Neptune cannot be said to belong to one more than to the other of these gentlemen, as the results of their calculations were almost the same. It was, however, by following the directions of M. le Verrier, that the planet was actually observed. On 23d September, 1846, Dr. Galle, one of the astronomers of the Royal Observatory at Berlin, received a letter from M. le Verrier, informing him that the longitude of the sought planet must then be 326°. On the same evening Dr. Galle, assisted by Professor Enké, discovered it in longitude 326° 52′. Thus was achieved one of the most wonderful triumphs of analytic investigation. The distance of this remote wanderer from the sun is 2,850,000,000 miles: its annual revolution is performed in 164 years, 219 days. Its diameter is 37,276 miles. In October, 1846, Mr. Lassell discovered a satellite of Neptune; it has since then been observed by other astronomers.

Comets are bodies which revolve round the sun in orbits of greater eccentricity than those of the planets. The appearance which one of them usually presents is that of a circular mass of illuminated vapour, to which there is frequently attached a train, apparently also composed of vaporous matter. The former is called the head, and the latter the tail of the comet. The illumination of the head is generally found to be greater towards its centre, where there is often discovered a bright central spot or nucleus, resembling a star or planetary disk. In general, however, when examined with a powerful telescope, the nucleus is found, like the rest of the body, to consist of nebulous matter. One of the most striking ocular proofs of the rarity of the matter of which comets are composed, is observed when one of them passes betwixt us and a star. When this occurs the star is not hid from our view, but is seen through the comet shining with almost its wonted brilliancy. A striking instance of this was noticed in October, 1858, when the bright star Arcturus, in the constellation Boötes, was seen shining through the tail of Donati's comet with undiminished splendour. On the same evening an observer at Glasgow saw through the head of that body, within a few seconds of its nucleus, a star of the seventh magnitude. Observation, however, is not the only method by which we can ascertain the densities of comets: we can by noticing the effects of mutual attraction weigh them against the masses of the planets. When two bodies moving in space approach one another, each by the force of gravitation exercises a power of drawing the other out of its orbit. The disturbances mutually produced being in the proportion of the disturbing masses, it is evident that if we know the weight of one of two bodies, and have ascertained the amount of mutual disturbance, the weight of the other can be calculated. But in the case of comets, though they have frequently approached planets so close as to be drawn considerably out of their orbits, their attraction has never produced the slightest perceptible effect upon the movements of any of the planets, planetoids, or satellites. Now since some of the comets are of greater volume than the sun, their masses must be extremely small. It has been supposed that their densities are in general probably thousands of times less than that of the atmosphere at the surface of the earth.

so little understood at present: all we know is, that their number is much greater than that of the planets; and that, like these, they roll in orbits, in some measure obedient to solar influence. Astronomers have endeavoured to calculate the returning periods of many of them; but experience has not, as yet, confirmed the veracity of their investigations. Indeed, who can tell when those wanderers have made their excursions into other worlds and distant systems, what obstacles may be found to oppose their progress, to accelerate their motions, or retard their return?

When Newton propounded the principles of the law of gravitation, the motions of none of the comets had been ascertained. So little was known regarding them, that they were popularly considered as the harbingers of some great event disastrous or otherwise; while the learned were not certain whether they belonged to the class of atmospheric phenomena, or whether, like the planets, they had their existence in the vast field of space. But the theory of gravitation had not long been promulgated, when astronomers turned their attention to the motions of the comets. The result of their investigations was to discover that, in obedience to the same forces which controlled the movements of the planets, they moved round the sun, but in orbits of very different curvatures. Newton had demonstrated that bodies acted upon by a central gravitating force must move in one or other of the curves known as conic sections. The motions of the planets and their satellites then discovered, were all confined to elliptical paths of eccentricity so small that they seemed almost circular. The comets were found to observe no such restriction, but taking advantage of the full latitude which the law of gravitation allowed them, they were discovered to move in elliptic orbits of various eccentricities, and also in hyperbolic and parabolic paths. Those moving in either of the two latter classes of orbits can scarcely be said to belong to our system. They seem to arrive fortuitously within the limits of the solar attraction, and to be drawn by it into hyperbolic or parabolic paths. After moving round the sun, they issue from the system in a direction never to return. But the elliptic comet forms a part of the solar system. The sun being placed in one of the foci of the ellipse, it moves round its orbit in a definite period, returning after regular intervals to the point of perihelion. Though, like the planets, a comet of this description completes its orbital revolution in a regular definite period, unlike them it is liable to have its period altered by being drawn out of its proper path by the attraction of some planet which it may approach. By the operation of the same cause, a comet, whose orbit has formerly been elliptic, may be thrown into a parabolic or hyperbolic path; and one which, judging from the direction which it had taken, we had expected never to see again, may return and become a regular visitant of our sky. An instance is on record of a comet which appeared in our system, and after making two revolutions round the sun in an elliptic orbit disappeared. This comet, known by the name of Lexell's, was discovered in June, 1770, and its period was ascertained to be 5½ years. The cause of its appearance was found to be owing to the influence of the planet Jupiter, which it had passed in 1767. As its period was exactly half that of the planet, after performing two revolutions round its orbit it again encountered it, when its course was so altered that it has never since visited the region of our vision.

The periods of a number of elliptic comets have been ascertained. They vary exceedingly; that of Enké's comet being about 1200 days, while it has been estimated that the comet of 1844 must take 100,000 years to complete its journey round its orbit.

The *Fixed Stars* are bodies which do not form part of our solar system. Owing to the vast distances to which they are removed from us, very little was known regarding them until recently, when by improvements in optical instruments the field of the astronomer's research was extended, and he was enabled to ascertain new facts regarding those stars he had already known, and to discover others of whose existence he had previously no idea. But while optical science has thus come to our aid, there has not been wanting genius to direct investigation, and to give it a definite and practical form. In particular, we are indebted to Sir William Herschel, and his illustrious son for their labours in this department of science, which, besides adding to our stores of information, have had the effect of stimulating and encouraging others to follow in the path of discovery.

The fixed stars do not appear to us all of one size, some are seen only with difficulty even under favourable circumstances, while others shine with intense lustre. By applying the well-known law of optics, that as we retire from a light it seems to diminish in size, this phenomenon is more naturally accounted for, than by supposing the stars to be of different orders of real magnitude. This conclusion is borne out by a fact which every one must have noticed, that the brightest stars are by far the least numerous, and that as they decrease in apparent brilliancy they seem to increase in number. Hence it has been inferred that they are placed at greater distances from one another, as great as that which separates the nearest of them from our sun. Observations have been made with the view of ascertaining the distances of some of the stars from the earth, and in the case of a few of them, results have been arrived at which may be admitted as proximately correct. But it is impossible by our ordinary method of expressing measurements in miles to convey to the mind any idea of the vast intervals of space which separate even the nearest of the stars from our planet. As we know that light travels at the rate of 192,000 miles per second, that has been accepted as the most convenient unit by which to express celestial distances. But even thus stated, the numbers are generally so unwieldy that we require to reduce them to the more extended divisions of time. Adopting this method of computing distance in the case of α Centauri, the nearest of the stars, we find that it would take about three and a half years for a ray of its light to reach the earth. This is ascertained by what is called parallax, that is, by the difference in the position of a star as seen by an observer from the two extremities of a diameter of the earth's orbit, or at the beginning and at the end of six months. As, after performing the half of her annual revolution round the sun, the earth is removed from the position which she formerly occupied by 190,000,000 miles, the distance of any star can be measured if it does not appear at precisely the same point when viewed from these two positions. But as even in the case of the nearest of the stars, it requires instruments of the most delicate construction to discover any sensible parallax, it is evident that, when we endeavour to sound the greater depths of immensity, we must employ some other method than that by which we fathom those portions which lie nearer to the region of our own system. Here the science of optics comes to our aid. From the well-established law that the apparent brightness of an object decreases as the square of its distance increases, it is evident that, if it take a telescopic power of 100 to magnify a star to the visible brilliancy of α Centauri, the star must be ten times more distant. But as magni-

But what we have hitherto attempted to sketch, is but a small part of that great fabric in which the Deity has thought proper to manifest his wisdom and omnipotence. There are multitudes of other bodies, dispersed over the face of the heavens, that lie too remote for examination: these have no motion, such as the planets are found to possess, and are, therefore, called *fixed stars;* and from their extreme brilliancy, and their immense distance, philosophers have been induced to suppose them to be suns, resembling that which enlivens our system. As the imagination also, once excited, is seldom content to stop, it has furnished each with an attendant system of planets belonging to itself; and has even induced some to deplore the fate of those systems, whose imagined suns, which sometimes happens, have become no longer visible.

But conjectures of this kind, which no reasoning can ascertain, nor experiment reach,

---

fying powers of much more than 100 have been employed, stars have been discovered separated from us by far greater intervals of space. The conclusion has been arrived at that from some of them it would take a ray of light 2600 years to reach our planet. Hence, we see them, not as they now are, but as they existed when Roman history first began; and like that colossal empire they may have long since passed away, though the fact of their decline and fall is to us still unrevealed.

It will be evident, even to the most superficial observer, that, owing to the vast distances to which they are removed from us, we should be unable to see any of the stars, did they not shine by their own inherent light. Hence we conclude that they are bodies similar to our own sun. And may we not carry the analogy still further, and infer that they also do not distribute their light in vain, but that each is the centre of revolving planets, to which it ministers continual supplies of light and heat?

To distinguish them from the planets, the stars are called *fixed*, but after careful examination they are observed to undergo a slow but constant change in position. This has been discovered to arise, not from the movements of the stars themselves, but from those of our sun with its attendant planets. It has been observed that the direction of this motion is to a point within the constellation Hercules. It is possible that our entire system, acted upon by a great central gravitating force, is carried through space in an orbital path similar to those in which the planetary bodies revolve, but of much vaster dimensions.

To a casual observer of the heavens, the stars appear to be scattered over its surface, without reference to any law of arrangement; but a minute examination with the telescope convinces us that their distribution over the celestial sphere follows a comparatively well-defined law, and that the density of their strata is subject to regular variations. Starting in any direction from either of two fixed points diametrically opposite, we find the stars to increase in number as we proceed, till we reach the Milky Way, where we discover them in clusters so dense that we are unable to count them. On one occasion, when Sir William Herschel had directed his telescope to this portion of the heavens, he estimated that by the diurnal revolution, upwards of 116,000 distinct stars had been carried in review before him in the course of fifteen minutes. He also estimated the probable depth of this mass of stars as equal to eighty times the distance of the nearest of the fixed stars from our system, and that from those placed in the more remote edges of its length and breadth, it would take a ray of light 20,000 years to reach the earth.

In the foregoing notes we have endeavoured to state some of the leading facts which the science of astronomy has presented to us. After adverting to the successive systematic arrangements, the laws of celestial movement, and the characteristics of the bodies which compose our solar system, we have passed into the sidereal regions, and have endeavoured to explore the depths of immensity. And now that we have arrived at the outer edge of the Milky Way, the question naturally arises: Have we reached the extremity of creation? Analogy answers No; and points to the conclusion, that as that portion of space which more immediately encircles us is crowded with stars, the limitless regions beyond are not the abodes of eternal gloom, but that there also the Creator has manifested himself in his works. The conclusion to which analogy had thus directed us, has been fully established by actual observation. Thin nebulous patches of light, which are but dimly seen with the naked eye, have been resolved by the telescope into clusters of stars, and in turn other nebulæ have been discovered, which, when examined with a higher optical power, are found to be similarly constituted. This department of astronomical investigation seems to present an endless field of research, for even with the colossal telescope of Lord Rosse, the observer discovers new objects of this description, which our present optical powers will not resolve. We have no means of calculating the distance of any of these nebulæ from our system, but we feel warranted in affirming, that light would not reach us from some of them in less than millions of years. As the stars of our firmament would individually be invisible if viewed from the surface of a star in one of these nebulæ, it can hardly be doubted that the whole of our stellar and solar systems must also present only the appearance of a nebula to a spectator in that position. There are doubtless those who will question the truth of our statement regarding the distance of some of the nebulæ from our system, because it assigns a greater antiquity to creation than is consistent with their interpretations of certain passages of Scripture. Such persons should remember that the Bible was never intended to teach natural science, but to instruct us in great moral truths, a knowledge of which can be acquired from no other source. Two revelations have been given to man, the one he can read on the sky above and in the earth beneath, the other is displayed on the sacred page. The one can only tell him the material history of the past, and the second causes by which the order of the universe is maintained; the other directs him on the path to a spiritual future, and to Him who is the first cause of all. In his treatise on the *Method of Divine Government*, Dr. M'Cosh very tersely expresses his views on this subject in the following passage:—"Science has a foundation, and so has religion. Let them unite their foundations, and the basis will be broader, and they will be two compartments of one great fabric reared to the glory of God. Let the one be the outer, and the other the inner court. In the one let all look, admire, and adore; and in the other, let those who have faith kneel, and pray, and praise. Let the one be the sanctuary where human learning may present its richest incense as an offering to God; and the other, the holiest of all, separated from it by a veil now rent in twain, and in which, on a blood-sprinkled mercy-seat, we pour out the love of a reconciled heart, and hear the oracles of the living God."

are rather amusing than useful. Though we see the greatness and wisdom of the Deity in all the seeming worlds that surround us, it is our chief concern to trace him in that which we inhabit. The examination of the earth, the wonders of its contrivance, the history of its advantages, or of the seeming defects in its formation, are the proper business of the *natural historian*. A description of this *earth*, its *animals*, *vegetables*, and *minerals*, is the most delightful entertainment the mind can be furnished with, as it is the most interesting and useful. I would beg leave therefore, to conclude these common-place speculations, with an observation which, I hope, is not entirely so.

A use, hitherto not much insisted upon, that may result from the contemplation of celestial magnificence, is, that it will teach us to make an allowance for the apparent irregularities we find below. Whenever we can examine the works of the Deity at a proper point of distance, so as to take in the whole of his design, we see nothing but uniformity, beauty, and precision. The heavens present us with a plan, which, though inexpressibly magnificent, is yet regular beyond the power of invention. Whenever, therefore, we find any apparent defects in the Earth, which we are about to consider, instead of attempting to reason ourselves into an opinion that they are beautiful, it will be wiser to say, that we do not behold them at the proper point of distance, and that our eye is laid too close to the objects, to take in the regularity of their connection. In short, we may conclude, that God, who is regular in his GREAT productions, acts with equal uniformity in the LITTLE.

CHAP. II.

A SHORT SURVEY OF THE GLOBE, FROM THE LIGHT OF ASTRONOMY AND GEOGRAPHY.

All the sciences are, in some measure, linked with each other, and before the one is ended, the other begins. In a natural history, therefore, of the earth, we must begin with a short account of its situation and form, as given us by astronomers and geographers: it will be sufficient, however, upon this occasion, just to hint to the imagination, what they, by the most abstract reasonings, have forced upon the understanding. The earth which we inhabit is, as has been said before, one of those bodies which circulate in our solar system; it is placed at a happy middle distance from the centre; and even seems, in this respect, privileged beyond all other planets that depend upon our great luminary for their support. Less distant from the sun than [Uranus,] Saturn, Jupiter, and Mars, and yet less patched up than Venus and Mercury, that are situated too near the violence of its power, the Earth seems in a peculiar manner to share the bounty of the Creator: it is not, therefore, without reason, that mankind consider themselves as the peculiar objects of his providence and regard.

Besides that motion which the earth has round the sun, the circuit of which is performed in a year, it has another upon its own axis, which it performs in twenty-four hours. Thus, like a chariot-wheel, it has a compound motion; for while it goes forward on its journey, it is all the while turning upon itself. From the first of these two arises the grateful vicissitude of the seasons; from the second, that of day and night.

It may be also readily conceived, that a body thus wheeling in circles will most probably be itself a sphere. The earth, beyond all possibility of doubt, is found to be so. Whenever its shadow happens to fall upon the moon, in an eclipse, it appears to be always circular, in whatever position it is projected; and it is easy to prove, that a body which in every position makes a circular shadow, must itself be round. The rotundity of the earth may be also proved from the meeting of two ships at sea: the topmasts of each are the first parts that are discovered by both, the under parts being hidden by the convexity of the globe, which rises between them. The ships, in this instance, may be resembled to two men who approach each other on the opposite sides of a hill; their heads will first be seen, and gradually as they come nearer they will come entirely into view.

However, though the earth's figure is said to be spherical, we ought only to conceive it as being nearly so. It has been found in the last age to be rather flatted at both poles, so that its form is commonly resembled to that of a turnip. The cause of this swelling of the equator is ascribed to the greater rapidity of the motion with which the parts of the earth are there carried round; and which consequently endeavouring to fly off, act in opposition to central attraction. The twirling of a mop may serve as a homely illustration; which, as every one hath seen, spreads and grows broader in the middle as it continues to be turned round.

As the earth receives light and motion from the sun, so it derives much of its warmth and power of vegetation from the same beneficent source. However, the different parts of the globe participate of these advantages in very different proportions, and accordingly put on very different appearances; a polar prospect, and a landscape at the equator, are as opposite in their appearances as in their situation.

The polar regions, that receive the solar beams in a very oblique direction, and continue for one half of the year in night, receive but few of the genial comforts which other parts of the world enjoy. Nothing can be more mournful or hideous than the picture which travellers present of those wretched regions. The ground,[1] which is rocky and barren, rears itself in every place in lofty mountains and inaccessible cliffs, and meets the mariner's eye at even forty leagues from shore. These precipices, frightful in themselves, receive an additional horror from being constantly covered with ice and snow, which daily seem to accumulate, and fill all the valleys with increasing desolation. The few rocks and cliffs that are bare of snow, look at a distance of a dark brown colour and quite naked. Upon a nearer approach, however, they are found replete with many different veins of coloured stone, here and there spread over a little earth, and a scanty portion of grass and heath. The internal parts of the country are still more desolate and deterring. In wandering through these solitudes, some plains appear covered with ice, that at first glance seem to promise the traveller an easy journey.[2] But these are even more formidable and more unpassable than the mountains themselves, being cleft with dreadful chasms, and everywhere abounding with pits that threaten certain destruction. The seas that surround these inhospitable coasts are still more astonishing, being covered with flakes of floating ice, that spread like extensive fields, or that rise out of the water like enormous mountains. These, which are composed of materials as clear and transparent as glass,[3] assume many strange and fantastic appearances. Some of them look like churches or castles, with pointed turrets; some like ships in full sail; and people have often given themselves the fruitless toil to attempt piloting the imaginary vessels into harbour. There are still others that appear like large islands, with plains, valleys, and hills, which often rear their heads two hundred yards above the level of the sea; and although the height of these be amazing, yet their depth beneath is still more so; some of them being found to sink three hundred fathom under water.[4]

The earth presents a very different appearance at the equator, where the sunbeams, darting directly downwards, burn up the lighter soils into extensive sandy deserts, or quicken all the moister tracts with incredible vegetation. In these regions, almost all the same inconveniences are felt from the proximity of the sun, that in the former were endured from its absence. The deserts are entirely barren, except where they are found to produce serpents, and that in such quantities, that some extensive plains seem almost entirely covered with them.[5]

It not unfrequently happens also, that this dry soil, which is so parched and comminuted by the force of the sun, rises with the smallest breeze of wind; and the sands, being composed of parts almost as small as those of water, they assume a similar appearance, rolling onward in waves like those of a troubled sea, and overwhelming all they meet with inevitable destruction.[6] On the other hand those tracts which are fertile, teem with vegetation even to a noxious degree. The grass rises to such a height as often to require burning; the forests are impassable from underwoods, and so matted above, that even the sun, fierce as it is, can seldom penetrate.[1] These are so thick as scarcely to be extirpated; for the tops being so bound together by the climbing plants that grow round them, though a hundred should be cut at the bottom, yet not one would fall, as they mutually support each other. In these dark and tangled forests, beasts of various kinds, insects in astonishing abundance, and serpents of surprising magnitude, find a quiet retreat from man, and are seldom disturbed except by each other.

---

[1] Crantz's Hist. Greenland, p. 3. [2] Ibid. 23. [3] Ibid. 27.

[4] So early as the year 1527, it was conceived that a passage might be effected to the East Indies by the north pole. It was not, however, till the year 1607 that any voyage was undertaken for the purpose of exploring the polar seas; when Henry Hudson was commissioned by the merchants of London, at their own charge, to attempt a passage by the pole to Japan and China. He failed in his object; and for upwards of a century no further attempt was made in this direction. The possibility of sailing round the north of the American continent, and thence into the Pacific by Behring's Straits, remained still an open question. The first attempt in recent times to solve this problem was made in 1818, and various other expeditions followed; but though considerable additions were thereby made to our knowledge of the polar seas, no satisfactory demonstration was obtained of the actual existence of a north-west passage. This achievement was reserved for Captain M'Clure of H.M.S. *Investigator*, who ascertained this important fact in the course of his search for Sir John Franklin and his companions (1850–54). Such a discovery, however, is only interesting in a geographical and scientific point of view, as the masses of ice and severity of the temperature render quite impossible all ordinary navigation in these seas.

[5] Adamson's Description of Senegal.

[6] Amongst the terrible visitations connected with the climates of the torrid zone and the countries adjoining, are the *simoom*, the *chamseen*, or *khamseen*, and the *harmattan*. The *simoom*, or *samiel*, that is, *poison*, is a noxious hot wind, which blows at the period of the equinoxes, on the borders of Arabia, in the neighbourhood of Mecca, on the Euphrates, and in Persia, and is fatal to animal life. It comes over burning deserts of sand, and its approach is indicated by terrible appearances. A dark yellow hue suddenly pervades the eastern horizon; a thick sulphureous exhalation rises from the ground, which is first hurried round in rapid gyrations, and then ascends into the air, and covers the whole heavens. Hissing and crackling noises are heard, and a hot current of air, accompanied by low sounds, rushes over the ground. Even the beasts manifest their terror by their howlings, and, when the burning current overtakes a caravan in the desert, bend their heads to the earth; camels plunge their nose and mouth into the sand. Travellers may have learned this means of safety from them, as they also throw themselves down with their faces to the ground, and lie immoveable until the hot exhalation has passed, which it does within half an hour at the most. Persons in a

In this manner the extremes of our globe seem equally unfitted for the comforts and conveniences of life; and although the imagination may find an awful pleasure in contemplating the frightful precipices of Greenland, or the luxurious verdure of Africa, yet true happiness can only be found in the more moderate climates, where the gifts of nature may be enjoyed, without incurring danger in obtaining them.

It is in the temperate zone, therefore, that all the arts of improving nature, and refining upon happiness, have been invented: and this part of the earth is, more properly speaking, the theatre of natural history. Although there be millions of animals and vegetables in the unexplored forests under the line, yet most of these may for ever continue unknown, as curiosity is there repressed by surrounding danger. But it is otherwise in these delightful regions which we inhabit, and where this art has had its beginning. Among us there is scarce a shrub, a flower, or an insect, without its particular history; scarce a plant that could be useful, which has not been propagated; nor a weed that could be noxious, which has not been pointed out.

CHAP. III.

A VIEW OF THE SURFACE OF THE EARTH.

When we take a slight survey of the surface of our globe, a thousand objects offer themselves, which, though long known, yet still demand our curiosity. The most obvious beauty that everywhere strikes the eye, is the verdant covering of the earth, which is formed by a happy mixture of herbs and trees of various magnitudes and uses. It has been often remarked, that no colour refreshes the sight so much as green: and it may be added, as a further proof of the assertion, that the inhabitants of those places where the fields are continually white with snow, generally become blind long before the usual course of nature.

This advantage, which arises from the verdure of the fields, is not a little improved by their agreeable inequalities. There are scarcely two natural landscapes that offer prospects entirely resembling each other; their risings and depressions, their hills and valleys, are never entirely the same, but always offer something new to entertain and refresh the imagination.

But to increase the beauties of the face of nature, the landscape is enlivened by springs and lakes, and intersected by rivulets. These lend a brightness to the prospect; give motion and coolness to the air; and, what is much more important, furnish health and subsistence to animated nature.

Such are the most obvious and tranquil objects that everywhere offer: but there are objects of a more awful and magnificent kind; the *Mountain* rising above the clouds, and topped with snow; the *River* pouring down its sides, increasing as it runs, and losing itself, at last, in the ocean; the *Ocean* spreading its immense sheet of waters over one half of the globe, swelling and subsiding at well-known intervals, and forming a communication between the most distant parts of the earth.

If we leave those objects that seem to be natural to our earth, and keep the same constant tenor, we are presented with the great irregularities of nature: the burning moun-

---

stream have nothing to fear. The bodies of those who perish by it swell, and very quickly begin to putrefy. The fine dust which the wind brings penetrates into all the folds of the clothes, and even into boxes and bales. It is not improbable that these and other hot winds are overcharged with electricity.—The simoom is different from the *chamseen*, or *khamseen*, a south-west wind, which blows three or four days, between July 15 and August 15, in Egypt, Arabia, and on the Persian Gulf, and is accompanied by similar appearances. It is very hot and drying. In those whom it surprises in the desert, the lungs are compressed, the breathing difficult, the skin dry; the body appears as if consumed by fire. The corpses of those who have thus perished are dried up, but do not putrefy. The same means of protection are employed as against the samiel. Still different from either of these winds is the *harmattan*, which blows periodically from the interior parts of Africa, towards the Atlantic Ocean. It prevails in December, January, and February, and is generally accompanied with a fog or haze that conceals the sun for whole days together. Extreme dryness is the characteristic of this wind; no dew falls during its continuance, which is sometimes for a fortnight or more. The whole vegetable creation is withered, and the grass becomes at once like hay. The human body is also affected by it, so that the skin peels off; but it checks infection and cures cutaneous diseases.

[1] Linnæi Amænit., vol. vi. p. 67.

tain, the abrupt precipice, the unfathomable cavern, the headlong cataract, and the rapid whirlpool.

If we carry our curiosity a little further, and descend to the objects immediately below the surface of the globe, we shall there find wonders still as amazing. We first perceive the earth, for the most part, lying in regular beds or layers, every bed growing thicker in proportion as it lies deeper, and its contents more compact and heavy. We shall find, almost wherever we make our subterranean inquiry, an amazing number of shells that once belonged to aquatic animals. Here and there, at a distance from the sea, beds of oyster-shells, several yards thick, and many miles over; sometimes testaceous substances of various kinds on the tops of mountains, and often in the heart of the hardest marble. These, which are dug up by the peasants in every country, are regarded with little curiosity; for being so very common, they are considered as substances entirely terrene. But it is otherwise with the inquirer after nature, who finds them, not only in shape, but in substance, everyway resembling those that are found in the sea; and he therefore is at a loss to account for their removal.

Yet not one part of nature alone, but all her productions and varieties, become the object of the speculative man's inquiry; he takes different views of nature from the inattentive spectator; and scarcely an appearance, how common soever, but affords matter of his contemplation; he inquires how and why the surface of the earth has those risings and depressions which most men call natural; he demands in what manner the mountains were formed, and in what consists their uses; he asks from whence springs arise, and how rivers flow round the convexity of the globe; he enters into an examination of the ebbings and flowings, and the other wonders of the deep; he acquaints himself with the irregularities of nature, and endeavours to investigate their causes; by which, at least, he will become better versed in their history. The internal structure of the globe becomes an object of his curiosity; and although his inquiries can fathom but a very little way, yet, if possessed with a spirit of theory, his imagination will supply the rest. He will endeavour to account for the situation of the marine fossils that are found in the earth, and for the appearance of the different beds of which it is composed. These have been the inquiries that have splendidly employed many of the philosophers of the last and present age,[1] and, to a certain degree, they must be serviceable. But the worst of it is, that, as speculations amuse the writer more than facts, they may be often carried to an extravagant length; and that time may be spent in reasoning upon nature, which might be more usefully employed in writing her history.

Too much speculation in natural history is certainly wrong; but there is a defect of an opposite nature that does much more prejudice; namely, that of silencing all inquiry, by alleging the benefits we receive from a thing, instead of investigating the cause of its production. If I inquire how a mountain came to be formed, such a reasoner, enumerating its benefits, answers, because God knew it would be useful. If I demand the cause of an earthquake, he finds some good produced by it, and alleges that as the cause of its explosion. Thus such an inquirer has constantly some ready reason for every appearance in nature, which serves to swell his periods, and give splendour to his declamation; everything about him is, on some account or other, declared to be good; and he thinks it presumption to scrutinize into its defects, or to endeavour to imagine how it might be better. Such writers, and there are many such, add very little to the advancement of knowledge. It is finely remarked by Bacon, that "the investigation of final causes[2] is a barren study; and like a virgin dedicated to the Deity, brings forth nothing." In fact, those men who want to compel every appearance and every irregularity in nature into our service, and expatiate on their benefits, combat that very morality which they would seem to promote. God has permitted thousands of natural evils to exist in the world, because it is by their intervention that man is capable of moral evil; and he has permitted that we should be subject to moral evil, that we might do something to deserve eternal happiness, by showing that we had rectitude to avoid it.

CHAP. IV.

A REVIEW OF THE DIFFERENT THEORIES OF THE EARTH.

Human invention has been exercised for several ages to account for the various irregularities of the earth. While those philosophers, mentioned in the last chapter, see nothing but beauty, symmetry, and order; there are others, who look upon the gloomy side of nature, enlarge on its defects, and seem to consider the earth on which they tread as one scene of extensive desolation.[1] Beneath its surface they observe minerals and waters confusedly jumbled together; its different beds of earth irregularly lying upon each other; mountains rising from places that once were level;[2] and hills sinking into valleys; whole regions swallowed by the sea, and others again rising out of its bosom. All these they suppose to be but a few of the changes that have been wrought in our globe; and they send out the imagination to describe its primeval state of beauty.

---

[1] Buffon, Woodward, Burnet, Whiston, Kircher, Bourquat, Leibnitz, Steno, Ray, Lyell, &c.

[2] Investigatio causarum finalium sterilis est, et veluti virgo Deo dedicata nil parit.

Of those who have written theories describing the manner of the original formation of the earth, or accounting for its present appearances, the most celebrated are Burnet, Whiston, Woodward, and Buffon. As speculation is endless, so it is not to be wondered that all these differ from each other, and give opposite accounts of the several changes which they suppose our earth to have undergone. As the systems of each have had their admirers, it is, in some measure, incumbent upon the natural historian to be acquainted, at least, with their outlines; and, indeed, to know what others have even dreamed in matters of science, is very useful, as it may often prevent us from indulging similar delusions ourselves, which we should never have adopted, but because we take them to be wholly our own. However, as entering into a detail of these theories is rather furnishing a history of opinions than things, I will endeavour to be as concise as I can.

The first who formed this amusement of earth-making into system, was the celebrated Thomas Burnet, a man of polite learning and rapid imagination. His *Sacred Theory*, as he calls it, describing the changes which the earth has undergone, or shall hereafter undergo, is well known for the warmth with which it is imagined, and the weakness with which it is reasoned; for the elegance of its style, and the meanness of its philosophy. "The earth," says he, "before the deluge, was very differently formed from what it is at present: it was at first a fluid mass; a chaos composed of various substances, differing both in density and figure: those which were most heavy, sunk to the centre, and formed in the middle of our globe a hard solid body; those of a lighter nature remained next; and the waters, which were lighter still, swam upon its surface, and covered the earth on every side. The air, and all those fluids which were lighter than water, floated upon this also; and in the same manner encompassed the globe; so that between the surrounding body of waters, and the circumambient air, there was formed a coat of oil, and other unctuous substances, lighter than water. However, as the air was still extremely impure, and must have carried up with it many of those earthy particles with which it once was intimately blended, it soon began to defecate, and to depose these particles upon the oily surface already mentioned, which soon uniting, the earth and oil formed that crust, which soon became a habitable surface, giving life to vegetation, and dwelling to animals.

"This imaginary antediluvian abode was very different from what we see it at present. The earth was light and rich; and formed of a substance entirely adapted to the feeble state of incipient vegetation; it was a uniform plain, everywhere covered with verdure; without mountains, without seas, or the smallest inequalities. It had no difference of seasons, for its equator was in the plane of the ecliptic, or in other words, it turned directly opposite to the sun, so that it enjoyed one perpetual and luxuriant spring. However, this delightful face of nature did not long continue in the same state; for, after a time, it began to crack and open in fissures; a circumstance which always succeeds when the sun exhales the moisture from rich or marshy situations. The crimes of mankind had been for some time preparing to draw down the wrath of Heaven; and they at length induced the Deity to defer repairing these breaches in nature. Thus the chasms of the earth every day became wider, and, at length, they penetrated to the great abyss of waters; and the whole earth, in a manner, fell in. Then ensued a total disorder in the uniform beauty of the first creation, the terrene surface of the globe being broken down: as it sunk the waters gushed out in its place; the deluge became universal; all mankind, except eight persons, were destroyed, and their posterity condemned to toil upon the ruins of desolated nature."

It only remains to mention the manner in which he relieves the earth from this universal wreck, which would seem to be as difficult as even its first formation: "These great masses of earth falling into the abyss, drew down with them vast quantities also of air; and, by dashing against each other, and breaking into small parts by the repeated violence of the shock, they at length left between them large cavities, filled with nothing but air. These cavities naturally offered a bed to receive the influent waters; and in proportion as they filled, the face of the earth became once more visible. The higher parts of its broken surface, now become the tops of mountains, were the first that appeared; the plains soon after came forward, and, at length, the whole globe was delivered from the waters, except the places in the lowest situations; so that the ocean and the seas are still a part of the ancient abyss, that have not had a place to return. Islands and rocks are fragments of the earth's former crust; kingdoms and continents are larger masses of its broken substance; and all the inequalities that are to be found on the surface of the present earth, are owing to the accidental confusion into which both earth and waters were then thrown."

---

[1] Buffon's Second Discourse.

[2] Senec. Quæst., lib. vi. cap. 21.

The next theorist was Woodward, who, in his Essay towards a Natural History of the Earth, which was only designed to precede a greater work, has endeavoured to give a more rational account of its appearances; and was, in fact, much better furnished for such an undertaking than any of his predecessors, being one of the most assiduous naturalists of his time. His little book, therefore, contains many important facts, relative to natural history, although his system may be weak and groundless.

He begins by asserting that all terrene substances are disposed in beds of various natures, lying horizontally one over the other, somewhat like the coats of an onion; that they are replete with shells, and other productions of the sea; these shells being found in the deepest cavities, and on the tops of the highest mountains. From these observations, which are warranted by experience, he proceeds to observe, that these shells and extraneous fossils are not productions of the earth, but are all actual remains of those animals which they are known to resemble; that all the beds of the earth lie under each other, in the order of their specific gravity; and that they are disposed as if they had been left there by subsiding waters. All these assertions he affirms with much earnestness, although daily experience contradicts him in some of them; particularly we find layers of stone often over the lightest soils, and the softest earth under the hardest bodies. However, having taken it for granted, that all the layers of the earth are found in the order of their specific gravity, the lightest at the top, and the heaviest next the centre, he consequently asserts, and it will not improbably follow, that all the substances of which the earth is composed, were once in an actual state of dissolution. This universal dissolution he takes to have happened at the time of the flood. He supposes, that at that time a body of water which was then in the centre of the earth, uniting with that which was found on the surface, so far separated the terrene parts as to mix all together in one fluid mass; the contents of which afterwards sinking according to their respective gravities, produced the present appearances of the earth. Being aware, however, of an objection, that fossil substances are not found dissolved, he exempts them from this universal dissolution, and, for that purpose, endeavours to show that the parts of animals have a stronger cohesion than those of minerals; and that, while even the hardest rocks may be dissolved, bones and shells may still continue entire.

So much for Woodward; but of all the systems which were published respecting the earth's formation, that of Whiston was most applauded, and most opposed. Nor need we wonder: for being supported with all the parade of deep calculation, it awed the ignorant, and produced the approbation of such as would be thought otherwise; as it implied a knowledge of abstruse learning, to be even thought capable of comprehending what the writer aimed at. In fact, it is not easy to divest this theory of its mathematical garb: but those who have had leisure, have found the result of our philosopher's reasoning to be thus: He supposes the earth to have been originally a comet; and he considers the history of the creation, as given us in Scripture, to have its commencement just when it was, by the hand of the Creator, more regularly placed as a planet in our solar system. Before that time he supposes it to have been a globe without beauty or proportion; a world in disorder; subject to all the vicissitudes which comets endure; some of which have been found, at different times, a thousand times hotter than melted iron; at others, a thousand times colder than ice. These alterations of heat and cold, continually melting and freezing the surface of the earth, he supposes to have produced, to a certain depth, a chaos entirely resembling that described by the poets, surrounding the solid contents of the earth, which still continued unchanged in the midst, making a great burning globe of more than two thousand leagues in diameter. This surrounding chaos, however, was far from being solid: he resembles it to a dense, though fluid atmosphere, composed of substances mingled, agitated, and shocked against each other; and in this disorder he describes the earth to have been, just at the eve of creation.

But upon its orbit being then changed, when it was more regularly wheeled round the sun, everything took its proper place; every part of the surrounding fluid then fell into a situation, in proportion as it was light or heavy. The middle, or central part, which always remained unchanged, still continued so, retaining a part of that heat which it received in its primeval approaches towards the sun; which heat, he calculates, may continue for about six thousand years. Next to this fell the heavier parts of the chaotic atmosphere, which serve to sustain the lighter: but as in descending they could not entirely be separated from many watery parts, with which they were intimately mixed, they drew down a part of these also with them; and these could not mount again after the surface of the earth was consolidated: they therefore surrounded the heavy first-descending parts in the same manner as these surround the central globe. Thus the entire body of the earth is composed internally of a great burning globe; next which is placed a heavy terrene substance, that encompasses it; round which is also circumfused a body of water. Upon this body of water, the crust of earth which we inhabit is placed so that, according to him, the globe is composed of a number of coats, or shells, one within the other, all of different densities. The body of the earth being thus formed, the air, which is the lightest substance of all, surrounded its surface; and the beams of the sun, darting through, produced that light which, we are told, first obeyed the Creator's command.

The whole economy of the creation being thus adjusted, it only remained to account for the risings and depressions on the surface of the earth, with the other seeming irregularities of its present appearance. The hills and valleys are considered by him as formed by their pressing upon the internal fluid which sustains the outward shell of earth, with greater or less weight: those parts of the earth which are heaviest sink into the subjacent fluid more deeply, and become valleys: those that are lighter rise higher upon the earth's surface, and are called mountains.

Such was the face of nature before the deluge: the earth was then more fertile and populous than it is at present; the life of man and animals was extended to ten times its present duration; and all these advantages arose from the superior heat of the central globe, which ever since has been cooling. As its heat was then in full power, the genial principle was also much greater than at present; vegetation and animal increase were carried on with more vigour; and all nature seemed teeming with the seeds of life. But these physical advantages were only productive of moral evil; the warmth which invigorated the body increased the passions and appetites of the mind; and, as man became more powerful, he grew less innocent. It was found necessary to punish this depravity; and all living creatures were overwhelmed by the deluge in universal destruction.

This deluge, which simple believers are willing to ascribe to a miracle, philosophers have long been desirous to account for by natural causes; they have proved that the earth could never supply from any reservoir towards its centre, nor the atmosphere by any discharge from above, such a quantity of water as would cover the surface of the globe to a certain depth over the tops of our highest mountains. Where, therefore, was all this water to be found? Whiston has found enough, and more than a sufficiency, in the tail of a comet; for he seems to allot comets a very active part in the great operations of nature.

He calculates, with great seeming precision, the year, the month, and the day of the week, on which this comet (which has paid the earth some visits since, though at a kinder distance) involved our globe in its tail. The tail he supposed to be a vaporous fluid substance, exhaled from the body of the comet by the extreme heat of the sun, and increasing in proportion as it approached that great luminary. It was in this that our globe was involved at the time of the deluge; and as the earth still acted by its natural attraction, it drew to itself all the watery vapours which were in the comet's tail; and the internal waters being also at the same time let loose, in a very short space the tops of the highest mountains were laid under the deep.

The punishment of the deluge being thus completed, and all the guilty destroyed, the earth, which had been broken by the eruption of the internal waters, was also enlarged by it; so that, upon the comet's recess, there was found room sufficient in the internal abyss for the recess of the superfluous waters; whither they all retired, and left the earth uncovered, but in some respects changed, particularly in its figures, which, from being round, was now become oblate. In this universal wreck of nature, Noah survived, by a variety of happy causes, to re-people the earth, and to give birth to a race of men slow in believing ill-imagined theories of the earth.

After so many theories of the earth which have been published, applauded, answered, and forgotten, Mr. Buffon ventured to add one more to the number. This philosopher was, in every respect, better qualified than any of his predecessors for such an attempt, being furnished with more materials, having a brighter imagination to find new proofs, and a better style to clothe them in. However, if one so ill qualified as I am may judge, this seems the weakest part of his admirable work; and I could wish that he had been content with giving us facts instead of systems; that, instead of being a reasoner, he had contented himself with being merely an historian.

He begins his system by making a distinction between the first part of it and the last; the one being founded only on conjecture, the other depending entirely upon actual observation. The latter part of his theory may, therefore, be true, though the former should be found erroneous.

"The planets," says he, "and the earth among the number, might have been formerly (he only offers this as conjecture) a part of the body of the sun, and adherent to its substance. In this situation, a comet falling in upon that great body, might have given it such a shock, and so shaken its whole frame, that some of its particles might have been driven off like streaming sparkles from red-hot iron; and each of these streams of fire, small as they were in comparison of the sun, might have been large enough to have made an earth as great, nay, many times greater, than ours. So that in this manner the planets, together with the globe which we inhabit, might have been driven off from the body of the sun by an impulsive force: in this manner also they would continue to recede from it for ever, were they not drawn back by its superior power of attraction; and thus, by the combination of the two motions, they are wheeled round in circles.

"Being in this manner detached at a distance from the body of the sun, the planets, from having been at first globes of liquid fire, gradually became cool. The earth also, having been impelled obliquely forward, received a rotatory motion upon its axis at the very instant of its formation; and this motion being greatest at the equator, the parts there acting against the force of gravity, they must have swollen out, and given the earth an oblate or flatted figure.

"As to its internal substance, our globe, having once belonged to the sun, it continues to be an uniform mass of melted matter, very probably vitrified in its primeval fusion. But its surface is very differently composed. Having been in the beginning heated to a degree equal to, if not greater than what comets are found to sustain; like them it had an atmosphere of vapours floating round it, and which, cooling by degrees, condensed and subsided upon its surface. Those vapours formed, according to their different densities, the earth, the water, and the air; the heavier parts falling first, and the lighter remaining still suspended."

Thus far our philosopher is, at least, as much a system maker as Whiston or Burnet; and, indeed, he fights his way with great perseverance and ingenuity, through a thousand objections that naturally arise. Having at last got upon the earth, he supposes himself on firmer ground, and goes forward with greater security. Turning his attention to the present appearance of things upon this globe, he pronounces from the view, that the whole earth was at first under water. This water he supposes to have been the lighter parts of its former evaporation, which, while the earthy particles sunk downwards by their natural gravity, floated on the surface, and covered it for a considerable space of time.

"The surface of the earth," says he,[1] "must have been in the beginning much less solid than it is at present; and, consequently, the same causes which at this day produce but very slight changes, must then, upon so complying a substance, have had very considerable effects. We have no reason to doubt but that it was then covered with the waters of the sea; and that those waters were above the tops of our highest mountains; since, even in such elevated situations, we find shells and other marine productions in very great abundance. It appears also that the sea continued for a considerable time upon the face of the earth: for as these layers of shells are found so very frequent at such great depths, and in such prodigious quantities, it seems impossible for such numbers to have been supported all alive at one time; so that they must have been brought there by successive depositions. These shells also are found in the bodies of the hardest rocks, where they could not have been deposited, all at once, at the time of the deluge, or at any such instant revolution; since that would be to suppose, that all the rocks in which they are found, were at that instant in a state of dissolution, which would be absurd to assert. The sea, therefore, deposited them wheresoever they are now to be found, and that by slow and successive degrees.

"It will appear also, that the sea covered the whole earth, from the appearance of its layers, which lying regularly one above the other, seem all to resemble the sediment formed at different times by the ocean. Hence, by the irregular force of its waves, and its currents driving the bottom into sand-banks, mountains must have been gradually formed within this universal covering of waters; and these successively raising their heads above its surface, must, in time, have formed the highest ridges of mountains upon land, together with continents, islands, and low grounds, all in their turns. This opinion will receive additional weight by considering, that in those parts of the earth where the power of the ocean is greatest, the inequalities on the surface of the earth are highest. The ocean's power is greatest at the equator, where its winds and tides are most constant; and, in fact, the mountains at the equator are found to be higher than in any other part of the world. The sea, therefore, has produced the principal changes in our earth; rivers, volcanoes, earthquakes, storms, and rain, having made but slight alterations, and only such as have affected the globe to very inconsiderable depths."

---

[1] Theorie de la Terre, vol. i. p. 111.

This is but a very slight sketch of Mr. Buffon's theory of the earth; a theory which he has much more powerfully supported, than happily invented; and it would be needless to take up the reader's time from the pursuit of truth in the discussion of plausibilities. In fact, a thousand questions might be asked this most ingenious philosopher, which he would not find it easy to answer; but such is the lot of humanity, that a single Goth can in one day destroy the fabric which Cæsars were employed an age in erecting. We might ask, how mountains, which are composed of the most compact and ponderous substances, should be the first whose parts the sea began to remove. We might ask, how fossil-wood is found deeper even than shells; which argues, that trees grew upon the places he supposes once to have been covered with the ocean. But we hope this excellent man is better employed than to think of gratifying the petulance of incredulity, by answering endless objections.[1]

CHAP. V.

OF FOSSIL SHELLS, AND OTHER EXTRANEOUS FOSSILS.

We may affirm of Mr. Buffon, that which has been said of the chemists of old; though he may have failed in attaining his principal aim, of establishing a theory, yet he has brought together such a multitude of facts

---

[1] The most important theories of the earth that have been advanced since Goldsmith's time are that of Werner, a professor of mineralogy, at Freyberg, in Saxony, and that of Hutton, a physician in Edinburgh. The followers of Werner were called Neptunists, as, according to his theory, water is the principal agent; and the followers of Hutton were called Vulcanists, from fire being a main agent in the Huttonian theory.

In Werner's theory it is assumed, that the materials of which the external crust of the earth is composed were either dissolved or suspended in water; and that the first class of rocks were deposited from a state of chemical solution, and thus exhibit a crystallized appearance. In the next series of rocks a few organized remains are observed, and hence it is concluded that marine animals were created about the time when these rocks, which are called *transition rocks*, were formed. After this period the waters of the earth holding in suspension particles of matter in a state of minute division, derived from the disintegration of the first series of rocks, began to subside more rapidly, and to deposit that series of strata which are denominated *secondary rocks*, or floetz rocks, because they are deposited in beds in a horizontal position. By the action of the air and the operation of water, the three classes of rocks being wasted down and broken, produced inequalities on the surface of the earth, and the waters still farther subsiding, deposited the different kinds of alluvial matters. In this system a fifth class of rocks, including those substances which are ejected by volcanoes, are called volcanic rocks. The formation of vertical rocks forms a prominent feature in theories of the earth. According to the theory of Werner, as the waters which held in solution or suspension the materials of which the solid parts of the earth are composed subsided, fissures were formed, and the waters holding in solution other earthy and metallic matters, again covered the earth, and deposited these matters in the fissures.

Hutton's theory, which was first published in 1788, and more fully developed in 1795, proceeds upon the principle that the surface of the globe is in a state of constant destruction and renovation. By the action of air and water, the hardest rocks are subject to decay and decomposition; and the disintegrated materials are conveyed to the ocean, and there accumulating, are formed into horizontal layers. The strata thus deposited are supposed to be consolidated by the heat of central fires; and to the action of the same subterraneous heat, the production of the primitive rocks, which are supposed to have been projected in a state of fusion from the bowels of the earth, is ascribed. To the operation of the same cause, all kinds of basaltic rocks are also supposed to owe their existence; and the materials of metallic veins, and of the vertical strata, have been ejected in a state of fusion from the centre of the earth, and deposited in fissures either previously formed, or which they form for themselves in their progress through the superincumbent strata. In this theory the operation both of fire and water is introduced; the disintegration and decomposition of the solid parts of the globe are produced by water, and, being deposited at the bottom of the ocean, are consolidated and hardened by heat; and a new series of rocks, projected in a state of fusion by the action of the same power, burst through the secondary strata, and elevating it to great heights, constitute a new series of primitive rocks. This system, then, holds out a perpetual system of renovation and decay, or, as it is assumed and expressed by Dr. Hutton himself, in the series of changes which are constantly going on, "there is no symptom of a beginning and no prospect of an end." See Playfair's Illustrations of the Huttonian Theory.

A violent controversy raged at the beginning of the century between the two schools of Freyberg and Scotland, whose very names became terms of reproach. The speculations of the rival philosophers were at length displaced by the institution in London, in 1807, of the Geological Society, which was established on the express understanding that the cultivators of the science should abstain from theories of the earth, and devote themselves exclusively to multiplying and recording relative to the history of the earth, and the nature of its fossil productions, that curiosity finds ample compensation, even while it feels the want of conviction.

Before, therefore, I enter upon the description of those parts of the earth which seem more naturally to fall within the subject, it will not be improper to give a short history of those animal productions that are found in such quantities, either upon its surface, or at different depths below it. They demand our curiosity; and, indeed, there is nothing in natural history that has afforded more scope for doubt, conjecture, and specu-

---

observations, patiently awaiting the result at some future period. The science of geology then became inductive, and ceased to be visionary. Instead of vainly endeavouring to discover how the earth was formed, geologists set themselves to work out the problem of the relative antiquity and succession of the rocks, by studying their mineralogical structure and organic remains. By the aid of zoological and botanical researches, the relations in time of every species of fossil plant and animal came to be determined, the succession of stratified rocks was established, and thus an instrument of investigation was presented to geology, which has placed the science upon an immoveable basis. Even before the London Society commenced its labours, the importance of this method of inquiry was perceived by William Smith, an unlettered English surveyor, but endowed with rare powers of observation and classification, and to whom belongs the merit of having first identified the secondary series of the strata of England, and established their succession by discovering the mutual dependence between these sedimentary deposits and the fossils they contain. Three nations have contributed principally to build up the fabric of geological science. Germany systematized the study of mineralogy in the school of Freyberg, where Werner first gave precision to the description of the mineral characters of rocks, besides directing attention to the constant superposition of certain mineral groups. The classification of the secondary rocks by their fossils was the work of Great Britain, where the researches of Smith, and the leading members of the London Geological Society, were primarily directed to this end, and principles were evolved which have since been found applicable to all parts of the old and the new world. The tertiary formations, with their natural history, were examined and described by the illustrious Baron Cuvier, and his associate, M. Brogniart, whose united work on the mineral geography and organic remains of the Paris basin appeared in 1808. The great importance attached to the natural history of organic remains, may be regarded as the characteristic feature of the progress of the science during the last fifty years. The study of organic forms disinterred from the rocks has grown up into a distinct branch of the science, under the name of Palæontology (the science of ancient beings), throwing light on the structure and mode of formation of the earth's crust, with its constituent stratified and unstratified parts. It is thus, as Professor Owen remarks, that "geology seems to have left her old handmaiden mineralogy, to rest almost wholly upon her young and vigorous offspring, the science of organic remains." A succinct view will afterwards be taken of the results o palæontological research, in the note on fossils. In the meantime, reverting to the Huttonian theory, it should here be stated that its author was the first writer on geology who disavowed the connection of the science with questions as to the origin of things, and the first also who attempted to dispense entirely with hypothetical causes, and to explain the former changes of the earth's surface by reference exclusively to agencies which are still in operation. The general soundness of Hutton's conclusions has been confirmed to a great extent by the progress of the science, in so far as the nature of the agencies is concerned; but as to the degree of their action—that is to say, whether the igneous and aqueous forces which united to impress its present configuration upon the earth's surface, are still operating over the globe with the same energy, is a question upon which there is much variety of opinion amongst geologists. Hutton's views have been adopted in the main by Sir Charles Lyell, who has extended and adapted them to the results of modern observation, and whose works are founded upon the theory, that all the phenomena exhibited by the earth's surface are due to causes which are still in operation.

The first subject of inquiry in studying the geological history of the earth, is the nature of the materials employed in its construction. Apart from speculative considerations as to the substances composing the central parts of the globe, founded on our knowledge of the products of volcanoes, or inferred from the researches of astronomy, the proper field of geological observation is limited chiefly to the phenomena exhibited in what is technically called the earth's crust, extending to a comparatively small depth from the surface. Chemistry teaches us that the seemingly boundless diversity of substances entering into the constitution of the solid rocks, or commingled and strewed over the surface of the ground, may be resolved into a few elementary bodies. In the more level countries, the principal varieties of the earthy compounds are comprised in the terms limestone, sandstone, and clay. Each of these great divisions of rocks contains essentially a peculiar species of earth which imparts to the mass its particular derivative character. Thus, lime is the basis of limestone; silica, of sandstone; alumina, of clay. Magnesia forms an ingredient in certain limestones; carbon, widely diffused through many rocks, is the essential element of coal and wood. Soda is the basis of common salt. On the other hand, the rocky masses forming mountain tracts, present crystallized minerals in an endless variety of combinations, but the composition of which is referable to a few earthy, metallic, and combustible substances. The great proportion of earthy minerals consists of the four substances, silica, alumina, lime, and magnesia, variously combined with alkalies and acids, and differently coloured by the presence of metallic oxides, &c. The whole of the gaseous, liquid, and solid compounds forming the crust of the globe are reducible to about sixty-three elementary bodies, so called, because in the present state of chemical science, they appear incapable of being decompounded. Fifty-one are metallic bodies, possessing various degrees of affinity for oxygen, eight are non-metallic combustibles, four are gases, and all of them are found in their simple state, or in various forms of combination, in the mineral kingdom. Many of these sixty-three primary ingredients being extremely rare, and others combining only upon certain principles, the number of mineral species really determined scarcely exceeds 500. Of these the geologist requires to acquaint himself, in the first instance, with not more than a tenth, to enable him to discriminate and recognise the different rocks, as limestone, sandstone, clay, various descriptions of slates, basalt, greenstone, porphyry, and granite. Having ascertained the principal constituents of the rocks, the next subject of inquiry is their arrangement on the surface of the earth. The most superficial survey of the cuttings of a railway, the sections of mines, or the courses of rock laid bare in cliffs and ravines by the hand of nature, shows that the solid lation. Whatever depths of the earth we examine, or at whatever distance within land we seek, we most commonly find a number of fossil shells, which being compared with others from the sea, of known kinds, are found to be exactly of a similar shape and nature.[1] They are found at the very bottom of quarries and mines, in the retired and inmost parts of the most firm and solid rocks, upon the tops of even the highest hills and mountains, as well as in the valleys and plains; and this not in one country alone, but in all places where there is any digging for marble, chalk, or any other terrestrial

---

materials of the earth are not piled together in chaotic confusion, but follow each other in a certain regularity of succession. For example, in travelling from Edinburgh or Glasgow to London, by the North-Western Railway, the train passes successively through the coal-fields of Lanarkshire; the slaty and crystalline rocks around Beattock, known to geologists as the silurian; new red sandstone at Carlisle; silurian again at Kendal; mountain limestone and coal measures again at Lancaster, Preston, Wigan, with intermediate recurrence of the overlying new red sandstone at Crewe, Stafford, &c.; lias limestone follows at Blisworth; oolite at Wolverton; greensand at Leighton; chalk at Tring; London and plastic clay at the metropolis. Natural sections of the rocks on many parts of the coast of Northumberland, Yorkshire, Kent, Hampshire, Cornwall, South Wales, and Cumberland, exhibit the limestones, clays, sandstones, and slates of England, arranged in distinct layers, piled one over the other in regular order, preserving a definite thickness, and found to maintain the same relations and proportions when traced inland throughout extensive tracts of territory. By observing the method in which different kinds of rocks follow each other, by studying their mineral structure, and, above all, their fossil organisms, geologists have been able to establish a definite and invariable order in the succession of strata, wherever the surface of the earth has been explored, whether in the old or the new world. The order is often interrupted by the omission of some particular system or formation, but it is never inverted. A may not be succeeded by B, but B or C will never be found going before A, or D before C; when one or more terms of the series are awanting, the links of the chain are pieced on to each other in the same order in which they would have followed had the series been complete, and never otherwise. "As a bookbinder (to borrow an illustration from Phillips) sometimes neglects to bind in a particular leaf, so nature sometimes omits a particular rock, but she never misplaces the rocks, as the careless workman sometimes misplaces his pages." After finding that the stratified masses are laid down in beds, and follow a certain order, our next observation is that these strata or layers are generally so disposed that their planes or faces deviate from the horizontal, and slope or "dip" in some one direction, or, to use the miner's phrase, are "tilted up" on their edges. It is now universally admitted that stratified rocks were deposited at the bottom of ancient seas. The waste of previously existing dry lands was drifted into the water, and there spread out into extensive beds of mud, sand, and gravel, containing very generally the remains of plants and animals which were in existence at the period of their formation. These stratified deposits would for ever have remained at the bottom of the primeval ocean, had not other forces been employed to raise them out of the sea as dry land; and the reasonable presumption is that these forces were the expansive powers of heat and vapour, which have operated through all the geological epochs in altering the relative level of sea and land, are still the agents in elevating large tracts of the earth (as in Chili, within a recent period; and in Scandinavia, where the elevatory process has been noted for a century), and which produce the phenomena of active volcanoes. The study of the rocks shows that the energy of this resistless agent was controlled by Almighty power, and rendered subordinate to infinite wisdom and goodness. Strata of various descriptions strewed out on the bottom of the sea have thus been raised and converted into habitable land, diversified with mountains, valleys, and plains, adapted to the condition of man, and fitted also to be the dwelling-place of the inferior tribes of terrestrial animals. From the strata being laid on their edges at high angles, and broken up into masses, as in the coal basins, we are able to reach mineral deposits in the lowest rocks, which would have continued at an unfathomable depth in the bowels of the earth, had the rocks containing them not been elevated from their horizontal position. By this wise and beneficent arrangement, the mineral treasures of coal and iron and the other metals have been laid at the feet of man, as the material sources of his power and wealth, and the instrument by which he has been able to subjugate the most energetic forces of nature to his will.

Unstratified differ from stratified rocks in their mineralogical structure, and in their being destitute of organic remains. Unstratified rocks are usually crystallized masses, often analogous to volcanic products, or compounds containing essential minerals which are not obtainable from water; but they are also procured in some instances by artificial heat, or produced by volcanic action. Stratified rocks have evidently been deposited successively from above, the lowest first, the uppermost last, following the law of gravity. Unstratified rocks, on the contrary, have been generated in the interior of the earth, and ejected from under the strata, as volcanic matter is erupted at the present time. They have no order of superposition, and have been protruded at various periods. Granite is thus found to have burst through the oldest fossiliferous rocks, and although most abundantly associated with primitive strata, it is also found penetrating formations so late as the chalk, and even extending into the tertiary period. The central nucleus or axis of many mountain districts—the Grampians for example—is a mass, or series of masses of granite and other unstratified rocks, by which the older stratified deposits have been elevated to a high angle, the latter strata being also frequently traversed by veins projected from the central nucleus. Greenstone or whin is another form of igneous rock widely diffused, forming hills of the secondary period, and often assuming a terraced or stair-like appearance, whence the name of trap (from *trappa*, Swedish for stair), applied to rocks of this description. Basalt is the hardest and most compact of the trap rocks, and often takes on a columnar form, as at the Giant's Causeway, Fingal's Cave in Staffa, and Samson's Ribs near Edinburgh. All the older secondary regions, such as those occupied by the old red sandstone, and the carboniferous systems, derive their configuration in large measure from the extensive development of trap rocks, to the elevation of which is no doubt owing the upheavals and dislocations of the coal-fields, whereby, as has already been noticed, deposits of fuel and iron have been raised from the depths of the primeval ocean, and brought within the reach of man for economical purposes.

The two great classes of rocks constituting the geological system are thus aqueous or stratified rocks, whose formation is due to the action of water; and

[1] Woodward's Essay towards a Natural History, p. 16.

matters, that are so compact as to fence off the external injuries of the air, and thus preserve these shells from decay.

These marine substances, so commonly diffused, and so generally to be met with, were for a long time considered by philosophers as productions, not of the sea, but of the earth. "As we find that spars," said they, "always shoot into peculiar shapes, so these seeming snails, cockles, and mussel-shells, are only sportive forms that nature assumes amongst others of its mineral varieties: they have the shape of fish, indeed, but they have always been terrestrial substances."[1]

With this plausible solution mankind were for a long time content; but upon closer inquiry, they were obliged to alter their opinion. It was found that these shells had in every respect the properties of animal, and not of mineral nature. They were found exactly of the same weight with their fellow-shells upon shore. They answered all the chemical trials in the same manner as sea shells do. Their parts, when dissolved, had the same appearance to view, the same smell and taste. They had the same effects in medicine, when inwardly administered; and, in a word, were so exactly conformable to marine bodies, that

---

unstratified or igneous rocks, whose formation is due to the action of fire. To these is added a third class, named metamorphic, or igneo-aqueous, formed by the action of water, and subsequently altered by the action of fire. These latter are stratified and crystalline in their texture, and destitute, so far as yet appears, of any remains of animals and plants, although many geologists believe that these rocks originally contained organic remains, the vestiges of which have been effaced by the metamorphic action to which they have been subjected. The metamorphic rocks, consisting of gneiss, mica slate, clay slate, and other schists, are classified as azoic, or destitute of the remains of living beings. The subsequent formations are arranged according to their fossil monuments, into—I. Palæozoic, or ancient life period; II. Mesozoic. or middle life period; III. Kainozoic, or recent life period. Each of these epochs embraces the following, or some equivalent provisional arrangement of systems, marked by certain zoological characters, and held to be the exponent of a definite period of time, and a record of the phases of life prevailing during that era:—

I. Palæozoic or Primary epoch.	1. Cambrian.	
	2. Silurian.	
	3. Devonian.	(Old Red.)
	4. Carboniferous.	
	5. Permian.	(New Red.)
II. Mesozoic or Secondary epoch	6. Triassic.	
	7. Jurassic or Oolite.	
	8. Cretaceous.	
III. Kainozoic or Tertiary epoch.	9. Eocene.	
	10. Miocene.	
	11. Pliocene.	
	12. Pleistocene.	
	13. Recent.	

This classification must not be received as embodying general laws resulting from inductions of facts, but simply as moveable landmarks laid down by geologists for their guidance in carrying on the work of investigation, and as outlines to be filled up by the patient observations of future years. The science has already been enriched by many valuable and important generalizations, which are no doubt destined to take their place in a mature system of the earth; but it is yet far from having reached the measure of attainment contemplated by the founders of the Geological Society, when theory may be securely based upon an adequate induction of facts. The limits of this note will only admit of a brief notice of some conclusions of the science in regard to which there is a general concurrence of opinion. In the first place, the agencies that now contribute to modify the surface of the globe, wearing down the solid land, and strewing the waste materials at the bottom of lakes, estuaries, and seas—submerging the dry land, and elevating the sea-bottom into new islands—rending the rocky masses, and raising new mountain chains—are the same in kind as those that have operated in all ages, although it is difficult to believe, with the followers of Lyell, that they continue to act with an equal degree of intensity, or over equally extended areas. The same law which regulates the geographical distribution of animals and plants is proved to have been in force during periods of time long antecedent to the appearance of man upon the earth. The study of extinct animals and plants not only teaches us that, to use the language of Professor Owen, "the globe allotted to man has revolved in its orbit through a period of time so vast, that the mind, in the endeavour to realize it, is strained by an effort like that by which it strives to conceive the space dividing the solar system from the most distant nebulæ;" it also reveals to us the conditions in which organized bodies existed upon the surface of the earth during the successive epochs which it is the province of geology to investigate and define. From the period when the earliest known plants and animals left their remains in the lowest fossiliferous rocks, vegetable life and growth have been dependent upon the light and heat of the sun, diffused over the earth through the atmosphere, which continues to transmit the same vivifying influences. In the remotest times the moisture vaporized on the earth and the sea, and ascending into the atmosphere became condensed into rain, and fell in fertilizing showers, leaving traces of rain-drops upon the once soft and yielding sand, and less equivocally in the relics of vegetables which could only have existed in the conditions of moisture, heat, and light, which are still essential to the maintenance and development of plant life. In the ripple mark upon the sandstone slab, we have a record of the subjection of the primeval sea to the influences which continue to regulate the tides of the ocean, or which agitate it with storms. The eye of the trilobite of the silurian era, and the eye of the ichthyosaurus of the wealden and the lias, indicate by their construction the same relations to light as the visual organs of existing marine animals, whence we infer a state of the atmosphere identical in its gaseous constituents, in its weight, density, and refractive property, with that which now envelopes the globe. From the researches of palæontology, we learn that in these conditions life has been enjoyed, and death has followed life throughout all ages, stretching back to the earliest traceable existence of living things; and that successive races of animals and plants have disappeared from the face of the earth, and been replaced by other races, called into being by creative power. After investigating into the different ages of mountain ranges, Elie de Beaumont believes that he has detected proofs of from sixty to a hundred distinct revolutions in the mountain systems of the globe, and he has endeavoured to show that these convulsions coincided with the successive disappearance

[1] Lowthrop's Abridgment, Phil. Trans. vol. ii. p. 426.

they had all the accidental concretions growing to them (such as pearls, corals, and smaller shells), which are found in shells just gathered on the shore. They were, therefore, from these considerations given back to the sea; but the wonder was, how to account for their coming so far from their own natural element upon land.[1]

As this naturally gave rise to many conjectures, it is not to be wondered that some among them have been very extraordinary. An Italian, quoted by Mr. Buffon, supposes them to have been deposited in the earth at the time of the crusades, by the pilgrims who returned from Jerusalem; who gathering them upon the sea shore, in their return carried them to their different places of habitation. But this conjecturer seems to have but a very inadequate idea of their numbers. At Touraine, in France, more than a hundred miles from the sea, there is a plain of about nine leagues long, and as many broad, whence the peasants of the country supply themselves with marl for manuring their lands. They seldom dig deeper than twenty feet; and the whole plain is composed of the same materials, which are shells of various kinds, without the smallest portion of earth between them. Here then is a large space, in which are deposited millions of tons of shells, that pilgrims could not have collected, though their whole employment had been nothing else. England is furnished with its beds, which, though not quite so extensive, yet are equally wonderful. "Near Reading, in Berkshire, for many succeeding generations, a continued body of oyster-shells has been found through the whole circumference of five or six acres of ground. The foundation of these shells is a hard rocky chalk; and above this chalk, the oyster-shells lie in a bed of greensand, upon a level, as nigh as can possibly be judged, and about two feet thickness."[2] These shells are in their natural state, but they were found also petrified, and almost in equal abundance[3] in all the Alpine rocks, in the Pyrenees, on the hills of France, England, and Flanders. Even in all quarries from whence marble is dug, if the rocks be split perpendicularly downwards, petrified shells and other marine substances will be plainly discerned.

"About a quarter of a mile from the river Medway, in the county of Kent, after the taking off the coping of a piece of ground there, the workmen came to a blue marble, which continued for three feet and a half deep, or more, and then beneath appeared a hard floor, or pavement, composed of petrified shells crowded closely together. This layer was about an inch deep, and several yards over; and it could be walked upon as upon a beach. These stones, of which it was composed (the describer supposes them to have always been stones), were either wreathed as snails, or bivalvular like cockles. The wreathed kinds were about the size of a hazel-nut, and were filled with a stony substance of the colour of marl; and they themselves, also, till they were washed, were of the same colour; but when cleaned, they appeared of the colour of bezoar, and of the same polish. After boiling in water they became whitish, and left a chalkiness upon the fingers."[4]

In several parts of Asia and Africa, travellers have observed these shells in great abundance. In the mountains of Castravan, which lie above the city Barut, they quarry out a white stone, every part of which contains petrified fishes in great numbers, and of surprising diversity. They also seem to continue in such preservation, that their fins, scales, and all the minutest distinctions of their make, can be perfectly discerned.[5]

---

of entire races of animals, and the introduction of new species. Taking into view not only the mountain systems, but the different formations of stratified rocks, Agassiz states his conviction, that although the evidence is not everywhere complete of a coincidence between the renovation of animals and plants, and the great physical revolutions which have followed each other, "It is already sufficiently extensive to exhibit a frequent synchronism and correlation, and to warrant the expectation that it will in the end lead to a complete demonstration of their mutual dependence, not as cause and effect, but as steps in the same progressive development of a plan which embraces the physical as well as the organic world." It is of importance also to observe that palæontology bears an unvarying testimony to the unalterable fixity of species. The great truth declared by Cuvier, that "species are fixed," has been demonstrated by the entire geological record, without a single exception, and is affirmed by Agassiz, and all naturalists of note, save Mr. Darwin, who has in his work on the origin of species, called the doctrine in question on theoretical grounds. It only remains to be noticed that, from the study of extinct and recent organisms, has been evolved the principle in natural science, that from the beginning of time, the animal and the plant has alike been formed according to a definite typical idea of structure, respectively belonging to the two classes of organisms—an idea characterized by extreme simplicity, never lost sight of in the multiplicity of created forms, and to which the infinitely diversified conditions and functions of animal and plant life are all rendered subordinate. This combination of unity of plan with structural adaptation to function is, in the animal organism, illustrated by the hoofs of the horse, the fins of the whale, the trowels of the mole, and the wings of the bat, being all formed of a few simple elements, after a uniform plan, yet modified and adapted to the conditions of the different animals—a change of mechanism corresponding to change of circumstances, and indicating in the unity of plan the unity and personality of the creative cause—even as the diversity of adaptation manifests the beneficence and wisdom of the creative power.

[1] Woodward, p. 43.

[2] Phil. Trans. vol. ii. p. 427.

[3] Buffon, vol. i. p. 407.

[4] Phil. Trans. p. 426.

[5] Buffon, vol. i. p. 408.

" From all these instances we may conclude, that fossils are very numerous: and, indeed, independent of their situation, they afford no small entertainment to observe them as preserved in the cabinets of the curious. The varieties of their kinds are astonishing. Most of the sea-shells which are known, and many others to which we are entirely strangers, are to be seen either in their natural state, or in various degrees of petrifaction.[1] In the place of some we have mere spar, or stone, exactly expressing all the lineaments of animals, as having been wholly formed from them. For it has happened, that the shells dissolving by very slow degrees, and the matter having nicely and exactly filled all the cavities within, this matter, after the shells have perished, has preserved exactly and regularly the whole print of their internal surface. Of these there are various kinds found in our pits; many of them resembling those of our own shores; and many others that are only to be found on the coasts of other countries. There are some shells resembling those that are never stranded upon our coasts;[2] but always remain in the deep:[3] and many more there are which we can assimilate with no shells that are known amongst us. But we find not only shells in our pits, but also fishes and corals in great abundance; together with almost every sort of marine production.

It is extraordinary enough, however, that the common red coral, though so very frequent at sea, is scarcely seen in the fossil world; nor is there any account of its having ever been met with. But to compensate for this, there are all the kinds of the white coral now known, and many other kinds of that substance with which we are unacquainted. Of animals there are various parts: the vertebræ of whales, and the mouths of lesser fishes; these, with teeth also of various kinds, are found in the cabinets of the curious; where they receive long Greek names, which it is neither the intention nor the province of this work to enumerate. Indeed, few readers would think themselves much improved, should I proceed with enumerating the various classes of the Conicthyodontes, Polyleptoginglimi, or the Orthoceratites. These names, which mean no great matter when they are explained, may serve to guide in the furnishing a cabinet; but they are of very little service in furnishing the page of instructive history.

From all these instances we see in what abundance petrifactions are to be found; and, indeed, Mr. Buffon, to whose accounts we have added some, has not been sparing in the variety of his quotations, concerning the places where they are mostly to be found. However, I am surprised that he should have omitted the mention of one, which, in some measure, more than any of the rest, would have served to strengthen his theory. We are informed, by almost every traveller that has described the pyramids of Egypt, that one of them is entirely built of a kind of freestone, in which these petrified shells are found in great abundance. This being the case, it may be conjectured, as we have accounts of these pyramids among the earliest records of mankind, and of their being built so long before the age of Herodotus, who lived but fifteen hundred years after the flood, that even the Egyptian priests could tell neither the time nor the cause of their erection; I say, it may be conjectured that they were erected but a short time after the flood. It is not very likely, therefore, that the marine substances found in one of them, had time to be formed into a part of the solid stone, either during the deluge, or immediately after it; and consequently, their petrifaction must have been before that period. And this is the opinion Mr. Buffon has so strenuously endeavoured to maintain; having given specious reasons to prove, that such shells were laid in the beds where they are now found, not only before the deluge, but even antecedent to the formation of man, at the time when the whole earth, as he supposes, was buried beneath a covering of waters.

But while there are many reasons to persuade us that these extraneous fossils have been deposited by the sea, there is one fact that will abundantly serve to convince us that the earth was habitable, if not inhabited, before these marine substances came to be thus deposited. For we find fossil-trees, which no doubt once grew upon the earth, as deep, and as much in the body of solid rocks, as these shells are found to be. Some of these fallen trees also have lain at least as long, if not longer, in the earth, than the shells, as they have been found sunk deep in a marly substance, composed of decayed shells and other marine productions. Mr. Buffon has proved that fossil shells could not have been deposited in such quantities all at once by the flood; and I think, from the above instance, it is pretty plain, that, howsoever they were deposited, the earth was covered with trees before the deposition; and, consequently, that the sea could not have made a very permanent stay. How then shall we account for these extraordinary appearances in nature? A suspension of all assent is certainly the first, although the most mortifying conduct. For my own part, were I to offer a conjecture, and all that has been said upon this subject is but conjecture, instead of supposing them to be the remains of animals belonging to the sea, I would consider them rather as bred in the numerous fresh-water lakes, that in primeval times covered the face of uncultivated nature. Some of these shells we know to belong to fresh waters; some can be assimilated to none of the marine shells now known;[1] why, therefore, may we not as well ascribe the production of all to fresh waters, where we do not find them, as we do that of the latter to the sea only, where we never find them? We know that lakes, and land also, have produced animals that are now no longer existing; why, therefore, might not these fossil productions be among the number? I grant that this is making a very harsh supposition; but I cannot avoid thinking that it is not attended with so many embarrassments as some of the former, and that it is much easier to believe that these shells were bred in fresh water, than that the sea had for a long time covered the tops of the highest mountains.[2]

---

[1] Hill, p. 646. [2] Littorales. [3] Pelagii.

CHAP. VI.

OF THE EARTH'S INTERNAL STRUCTURE.[3]

Having, in some measure, got free from the regions of conjecture, let us now proceed to a description of the earth as we find it by examination, and observe its internal composition, as far as it has been the subject of experience, or exposed to human inquiry. These inquiries, indeed, have been carried but to a very little depth below its surface, and even in that disquisition men have been conducted more by motives of avarice than of curiosity. The deepest mine, which is that at Cotteberg in Hungary,[4] reaches not more than three thousand feet deep; but what proportion does that bear to the depth of the terrestrial globe, down to the centre, which is above four thousand miles? All, therefore, that has been said of the earth, to a deeper degree, is merely fabulous or conjectural; we may suppose, with one, that it is a globe of glass;[5] with another, a sphere of heated iron;[6] with a third, a great mass of waters;[7] and with a fourth, one dreadful volcano;[1] but let us at the same time show our consciousness that all these are but suppositions.

---

[1] Hill's Fossils, p. 41.

[2] Geology is silent when it is questioned concerning the origin of things. The mystery of creation belongs to revealed truth. "Through faith we understand that the worlds were framed by the word of God, so that things which are seen were not made of things which do appear." Out of nothing, God made the heavens, the earth, the sea, and all that in them is. But science confirms the sublime intimations of the Bible, by affording evidences, ever increasing in variety and force, of the almighty power which planned the universe, the infinite wisdom which controls the laws of material nature, and the benevolent providence which watches over every living thing. Geology, more especially, bears unequivocal testimony to repeated acts of creative power in the progress of the earth's history. It teaches us that man and the present races of animals and plants are not the only created beings which have inhabited the surface of the globe, but that they are the last term of a series stretching back to the earliest epochs to which scientific research is capable of extending. There are embedded in the rocks constituting the earth's crust, the remains of multitudes of animals and plants, different from those now existing, and differing not less from each other at successive periods; showing that with corresponding changes on the surface of the globe itself, entire races disappeared, and were replaced by other tribes of the animal and the vegetable kingdoms, created with an express adaptation to those altered physical conditions. It being only in sedimentary rocks, formed originally at the bottom of ancient lakes, estuaries, and seas, and subsequently elevated into dry land, that the remains of extinct organisms are discovered, the greatest proportion necessarily consists of marine forms. Land animals and plants drifted into the sea by floods, river currents, and accidental causes, naturally form a smaller numerical proportion. The same reason accounts for only the hard parts of these relics of ancient life being usually preserved, the softer and more perishable tissues of animals and vegetables having in general been decomposed by the action of the water. Their constituent parts have usually undergone a chemical change, and are turned into stone, atom after atom of the animal or vegetable structure being removed and replaced by deposits of silicious or flinty matter, by lime, and not unfrequently by iron pyrites. Many of the original bodies have entirely disappeared, leaving only casts of their shapes as if taken from a mould; or impressions printed upon the smooth surface of the stratum or bed of sandstone or limestone, and laid up like prints in a book; or sculpturesque forms deeply inscribed in the surface as if "by a pen of iron, and laid up in the rock for ever." To all these varieties of the record of the ancient life periods is popularly applied the name of *fossils* or *petrifactions*. The study and classification of extinct beings, their distribution in space and time, constitute, as has already been stated, the science of Palæontology. In order to acquire an idea of the successive extinctions and creations of living beings, and of the incalculable periods of time through which they have followed each other in the past history of the planet—from that inconceivably remote epoch "in the beginning," when "God created the heavens and the earth," down to the commencement of the present state of things, when the surface of the globe was re-created and fitted to become the theatre of moral events of enduring importance—it is necessary to take up the subject where the former note leaves it, and connect the history of the rocky formations, so far as it has been cursorily sketched, with their corresponding history as great life periods. It will simplify the subject and exhibit the relations of the different series, to add to the list of geological periods and systems already given, a corresponding statement of *formations*, the term applied to groups of strata covering a certain geographical area, and all containing some fossils in common, irrespective of the component ingredients of the rocks, whether limestone, sandstone, or clay. For this purpose it will be convenient to adopt the following table, prepared

[3] See note on p. 17.
[4] Boyle, vol. iii. p. 240.
[5] Buffon.
[6] Whiston.
[7] Burnet.

Upon examining the earth, where it has been opened to any depth, the first thing that occurs is the different layers or beds of which it is composed; these all lying horizontally one over the other like the leaves of a book, and each of them composed of materials that increase in weight, in proportion as they lie deeper. This is, in general, the disposition of the different materials, where the earth seems to have remained unmolested; but this order is frequently in-

Palæozoic or Ancient Life Period.—Following the ascending series of formations, we begin with the lowest and oldest portion of the palæozoic or ancient life period, namely, the *Cumbrian or Cambrian, and the Silurian systems*, in which the earliest traces of animals are discovered. It is not, however, to be thence inferred, that in these rocks the geologist reaches what he calls "the base line of life." Animals and plants may have existed in profusion during the prolonged period when the rocks named metamorphic were deposited in the depths of the primeval ocean; but, as has been already remarked, the heat to which these stratified deposits have been manifestly subjected before their elevation in mountain masses, is held to afford an adequate cause for the disappearance of

---

by Professor Ramsay for his article on Geology, in the new edition of the Popular Encyclopedia (Blackie and Son), as embracing the complete European series, irrespective of some minor details:—

Periods.	Epochs.	Groups.	Formations.
POST TERTIARY AND TERTIARY OR CAINOZOIC.	Post Tertiary.		Historical; and recent Peat with human remains, &c., and alluvium. Post Pliocene.
	Upper Tertiary.	Newer Pliocene or Pleistocene.	Glacial Drift, &c., and Norwich Crag.
		Older Pliocene.	Red Crag. Coralline Crag.
	Miocene or Middle Tertiary.	Absent in Britain, except freshwater leaf bed in the isle of Mull, and the Lignite of Antrim, and Bovey-Tracey. All doubtful.	
	Eocene or Lower Tertiary.	Upper Eocene.	Hempstead beds.
		Middle Eocene.	Bembridge beds. Headon beds. Headon Hill sand and Barton clay. Brackleham and Bagshot beds.
		Lower Eocene.	London clay. Plastic clay. Thanet sands.
SECONDARY OR MEZOZOIC.	Cretaceous or Upper Secondary.	Upper Cretaceous.	Maestricht and Faxoe beds absent in England. Chalk. Upper greensand. Gault.
		Lower Cretaceous.	Lower greensand or Neocomian. Weald clay and Hastings sand.
	Oolitic and Liassic or Middle Secondary.	Upper Oolite.	Purbeck beds. Portland Oolite and sand. Kimmeridge clay.
		Middle Oolite.	Calcareous grit and Coral rag. Oxford clay and Kelloway rock.
		Lower Oolite. Great Oolite.	Cornbrash and Forest marble. Great or Bath Oolite. Stonesfield slate.
		Lower Oolite. Inferior Oolite.	Fuller's earth and Fuller's earth rock. Inferior oolite.
		Lias.	Upper lias sand and clay. Marlstone. Lower lias clay and limestone.
	Lower Secondary.	Trias or New red series.	New red marl and sandstone (Keuper). Muschelkalk, absent in Britain. New red sandstone (Bunter).
PALÆOZOIC.	Upper Palæozoic.	Permian.	Magnesian limestone (Zechstein). Sandstone, red marl, conglomerate, and breccia (Rothe-todte liegende).
	Middle Palæozoic.	Upper Carboniferous.	Coal-measures.
		Lower Carboniferous.	Carboniferous limestone and shale, with coal in places.
		Devonian.	Devonian or Old red sandstone.
	Lower Palæozoic.	Upper Silurian.	Tilestone. Upper Ludlow rocks. Aymestry limestone. Lower Ludlow rocks. Wenlock limestone. Wenlock shale. Woolhope limestone. Tarannon shale.
		Middle Silurian.	Upper Llandovery rocks or Pentamerus lime and sandstone. Lower Llandovery rocks.
		Lower Silurian.	Caradoc sandstone or Bala beds. Llandeilo flags and slate. Lingula beds.
		Cambrian.	Cambrian.

[1] Kircher.

verted; and we cannot tell whether from its original formation, or from accidental causes. Of different substances, thus disposed, the far greatest part of our globe consists, from its surface downwards to the greatest depths we ever dig or mine.[1]

The first layer most commonly found at the surface, is that light coat of blackish mould, which is called by some *garden earth*. With this the earth is everywhere invested, unless it be washed off by rains, or removed by some other external violence. This seems to have been formed from animal and vegetable bodies decaying, and thus turning into

---

almost every vestige of organized structure; and the supposition that animals and plants had not been called into existence during the epoch in question rests, therefore, upon purely negative evidence. The varieties of structure and typical form, discovered amongst the earliest monuments of ancient life, reveal a law of creation as to which it is of the highest importance to possess a distinct conception. The study of modern zoology shows that animals have been created in separate groups or classes, constructed upon a definite type, which is recognizable amidst every diversity of adaptation to the conditions and functions of the animal, and never passing into each other by any supposed process of development or transmutation. The divisions first established by Cuvier, and still adopted with some immaterial modifications, are the Radiata, Articulata, Mollusca, and Vertebrata. The researches of palæontology conclusively establish the application of the principle of typical structure, within the limits of these groups, to the animals of all past ages; and botanists demonstrate a corresponding unity of plan and purpose in the construction of vegetables in every period of the earth's history. In conformity with this fundamental principle, the fossils of the earliest system prove that representatives of all the different groups of animals, the radiate, articulate, molluscan, and vertebrate, were all produced upon the surface of the earth within the primary epoch embraced by the Cambrian and Silurian systems, together constituting the oldest and earliest fossiliferous rocks. In the lower beds of these systems the radiate and articulate types abound, together with some of the Mollusca, including animals exhibiting the most advanced structure of the class; and in the upper beds of the Silurian appear the remains of fishes, representing the vertebrate type. The figures in Plates IV. and V. afford a sufficient variety of characteristic fossil illustrations for the purposes of this brief sketch. The simplest structure which presents itself is that of the zoophyte, various species of which appear in these ancient formations. The Graptolite (fig. 4) represents a numerous family of extinct animals of this description, allied to the sea-pens of modern times, if their affinity be not, as some suppose, with the tribe of existing zoophytes living together in organic union, in the plant-like structures popularly known as polypidoms. The Trilobite (Asaphus, fig. 2, and Bronteus, fig. 8), belong to a family exclusively confined to the palæozoic age, and having its largest development in the Silurian system. It was an articulated animal of the crustacean class, with the trunk segments divided into three lobes (whence the name), the head covered by a shield, and a tail composed of a number of joints. The eyes of this animal, the earliest visual organ yet discovered, are frequently well preserved in a fossil state, and present a marvel of constructive skill in a creature so simple and primitive. They resemble the compound eyes of existing crustaceans and insects, and the lenses of which they are composed can often be discerned without the aid of a glass. In the Asaphus tyrannus, one of the largest species, each eye is computed to possess 6000 distinct facets or visual tubes. The lowest bed of the Silurian derives its name from containing in abundance the shells of the Lingula (fig. 1), belonging to the Brachiopoda or arm-footed class of molluscs, having peculiar appendages in the interior, and represented also by the Terebratula or lamp-shell. Species of Pentamerus (fig. 3), a shell-fish of the same class, occur in the upper beds of the Silurian, and in all the strata below the carboniferous limestone. The highest class of molluscs, namely, the cephalopods, or head-footed, are represented by the Orthoceras (fig. 5), with a chambered shell, like an unrolled Nautilus. Numerous corals and encrinites (stone-lilies) occur in the lower series of rocks, which also contain impressions and carbonized remains of plants, apparently fucoids or sea-weeds; and amongst the diversified organisms of this primordial zone of life are detected the teeth, scales, and defences of fish of the shark family, the earliest indications of the vertebrate type of structure, and first occurring in the upper Ludlow strata, forming the most recent beds of the Silurian system.

Devonian or Old Red Sandstone System.—The system known as the Old Red Sandstone, or the Devonian, from the occurrence of the rocks in Devonshire, preeminently represents an age of fishes, whose remains exhibit a structure peculiar to the period, and widely different in many respects from that of the existing race of fishes. Some of them had extraordinary forms, which have caused them to be often mistaken for the remains of entirely different animals. The Pterichthys, with its two wing-like appendages (fig. 6), may be taken as an example. The species figured in the plate bears the honoured name of Hugh Miller, who first discovered the fish in the rocks of the old red in Scotland, where, indeed, they were first elevated to the rank of a system, and many of their characteristic fossils brought to light, by the genius and industry of that remarkable man. The Cephalaspis, another fish of the period, bears some resemblance to the outline of a saddler's knife. A third form, that of the Coccosteus, has been compared to a paper kite with a long tail. These fishes were encased in a covering of hard, bony, shining plates (ganoid). The oldest known reptilian remains have been discovered in this formation, near Elgin. Corals, crinoids, trilobites, and various species of molluscs are also yielded by the rocks of this system. Amongst the Devonian brachiopods may be mentioned the anomalous fossil, called Calceola sandalina (fig. 7), which is peculiar to the limestones of this system, as is the genus Davidsonia, belonging to the same class. The upper beds contain the remains of land-plants, some of which are identical with those of the carboniferous limestone. Miller discovered a fragment of fossilized coniferous wood in the lower old red of Cromarty.

Carboniferous or Coal System.—The prevailing fossils of this system are vegetable, and point unequivocally to an age of plants. In the British coal-fields alone, about 300 species of fossil plants are known, of which a large proportion are ferns (fig. 11), many of them arborescent. Calamites (fig. 12) reed-like plants—various species of Lepidodendron, resembling gigantic club-mosses—Sigillaria and Stigmaria (fig. 10), the former the stem, and the latter the roots or rhizomes of a tree which appears to have no affinity with any existing vegetable—are the other principal plants found embedded in the carboniferous rocks, and to the accumulated remains of all of which we are indebted for our rich deposits of fuel. The coal-plants are supposed to have grown in a climate humid, mild, and equable, such as is known to be most favourable for the

[1] Woodward, p. 9.

its substance. It also serves again as a storehouse, from whence animal and vegetable nature are renewed; and thus are all vital blessings continued with unceasing circulation. This earth, however, is not to be supposed entirely pure, but is mixed with much stony and gravelly matter, from the layers lying immediately beneath it. It generally happens, that the soil is fertile in proportion to the quantity that this putrified mould bears to the gravelly mixture; and as the former predominates, so far is the vegetation upon it more luxuriant. It is this external covering that supplies man with all the true

---

production of ferns and other allied plants at the present time. The same, or nearly the same, organic remains, vegetable and animal, are found in the coal-fields of the British Islands, and the United States and North America generally, and even in Greenland. In Germany the same species of coal-plants are described by Göppert, which abound in the coal-fields of Clydesdale. Numerous species of corals and crinoids occur in the system. The trilobite still presents 4 genera and 16 species. Three insects have been detected. Excepting the footprints of reptiles observed in the United States, no traces of land-animals have been discovered anywhere in the carboniferous rocks, although many of the strata are of fresh-water origin. Brachiopod shells are very abundant, comprising no fewer than 15 genera and 191 species, amongst the most characteristic of which are Producta, 43 species, and Spirifer, 57 species. The Producta gigantea (fig. 13) is a well-known carboniferous form; Spirifer striatus (fig. 14) belongs to an allied family. The Lamellibranchiate class of molluscs, with plate-like gills like the modern oyster and mussel, exhibits the large number of 44 genera and 282 species. Gasteropods (belly-footed, like the whelk and limpet) present 21 genera and 167 species, amongst which are 21 species of Euomphalus (fig. 9), 23 of Bellerophon (fig. 15), and 137 of Cephalopoda, the principal of which were Goniatites (fig. 16), Nautilus, and Orthoceras. Of fish, 60 genera and 170 species have been described. The lower group of coal-measures in Scotland is characterized by fresh-water or estuary remains, showing that during the deposition of the strata there were occasional alternations of marine and fresh-water conditions. Fresh-water mussels (Unio) sometimes constitute entire bands of shell-limestone.

Permian System.—The Permian system forms the lower division of a series of rocks formerly grouped under the title of the New Red Sandstone, but which is now separated into two departments, the Permian forming the upper member of the palæozoic period, and immediately succeeding or over-lying the coal, and the upper division of the new red being transferred on account of its peculiar fossils to the base of the secondary or Mesozoic period. The system derives the name of Permian from its being largely developed in Perm, in European Russia. The fossils of this group are not numerous. The plants are allied to the carboniferous types. Many of the corals and shells also partake of the generic forms of the carboniferous system. Of 16 fishes, the most characteristic is the Palæoniscus (fig. 18), combining with rhomboid scales (fig. 18), a heterocercal tail, in which the vertebral column is prolonged into the upper lobe of the tail; whereas in the fishes of the secondary and subsequent epochs, the tail, in the great majority of species, separates into two equal lobes (homocercal) without the vertebral column being extended into either lobe. The magnesian limestone is associated with the Permian system; and that of Bolsover in Derbyshire was employed in building the new Houses of Parliament at Westminster.

MESOZOIC OR SECONDARY PERIOD.—*Triassic System.*—This system introduces the middle life period, into which few of the genera and none of the species of animals pass from the ancient life period. The fossils of the Trias assume relations more closely allied to the oolite above than to the carboniferous below. One remarkable feature of the system is the almost total disappearance of the Brachiopoda, so profusely disseminated through the palæozoic formations as to have obtained for the Terebratulæ and other species the name of the "fossil aristocracy," distinctive of their extreme antiquity, as well as of their numerical predominance. Footprints of animals have been found imprinted on the surface of rocks of this system, at Corncockle Muir in Dumfriesshire, at Storeton in Cheshire, in Saxony, and on the Connecticut river in America. From the hand-like shape of the impression, the name of Cheirotherium was first given to the unknown animal that had left the footprints. They are now assigned to a batrachian or frog-like animal, named Labyrinthodon, some species of which must have been of huge dimensions, the largest impressions being from eight to ten inches in length (fig. 19, footmarks and tooth of Labyrinthodon). Footprints of birds have also been discovered in the United States, the largest impression of a single foot being 18 inches in length. The still more important discovery was made some years ago in Triassic rocks at Würtemburg, of the molar teeth and fragments of bone of a mammalian animal, which received the name of Microlestes antiquus. This being the oldest recorded mammalian relic, and as yet unique of its kind, the discovery is one of much interest. Rock-salt is yielded by the salt-mines and brine-springs of Cheshire and Worcester, connected with this formation.

Oolitic and Liassic System.—The characteristic fossils of the middle secondary group indicate an age of reptiles, and the entire organic remains now assume forms altogether distinct from those of the more ancient rocks. The graptolites and trilobites of the Silurian age have disappeared; the singular fishes of the old red sandstone recur no more; the peculiar flora of the coal-period is replaced by new vegetable productions; and the heterocercal tail no larger marks the ancient type of the fishes. The Triassic system exhibits the dawn of a new state of the organic world, which culminates in the fossils of the Lias, the Oolite, and the Wealden. The Lias limestones occupy the lowest place in the group, are largely developed in England, and occur partially in Scotland, in the isle of Skye, and on the shores of the Sound of Mull. The corals of this formation are few, and occur chiefly in Skye. Star-fishes and sea-urchins, encrinites or stone-lilies, and other radiate forms, become abundant. Fossil insects have been detected in considerable numbers. The cephalopod, or highest type of molluscan life, is largely represented by ammonites, belemnites, and nautili. The ammonite is an extinct animal, and differed from the nautilus in having the siphuncle or tube external, whereas in the nautilus it is central or internal (Ammonites obtusus, fig. 22). The nautilus is still represented by three or four species in existing seas, the pearly nautilus being a familiar example. The Gryphæa incurva (fig. 20), so abundant in some of the lias limestones as to give them their distinctive name, exhibits the elegant form of one of the oysters of the period, and Avicula cygnipes (fig. 21) is one of the pearl-oysters. The species of fish described number 107. A compressed, deep-bodied fish, Dapedius politus (fig. 19^{a}) is a member of one the ichthyic families of the age. But the chief interest of the system centres in its marvellous reptiles, some of gigantic size, and all of riches he enjoys. He may bring up gold and jewels from greater depths; but they are merely the toys of a capricious being, things upon which he has placed an imaginary value, and for which fools alone part with the more substantial blessings of life. "It is this earth," says Pliny,[1] "that, like a kind mother, receives us at our birth, and sustains us when born." It is this alone of all the elements around us, that is never found an enemy to man. The body of waters deluge him with rains, oppress him with hail, and drown him with inundations. The air rushes in storms, prepares the tempests, or

---

them amongst the most remarkable structures revealed by researches into the annals of ancient life upon the earth's crust. The Ichthyosaurus, or fish-lizard (fig. 23), more than thirty species of which have been discovered, has been described in general terms as possessing the snout of a porpoise, the teeth of a crocodile, the head of a lizard, the vertebræ of a fish, and the paddles of a whale. The enormous magnitude of the eye was one of the most remarkable features of the head, and it is inferred from the quantity of light admitted by the expanded pupil, that the animal must have possessed great powers of vision, especially in the dark. The structure of the organ also indicates an optical instrument which could be employed either as a telescope or a microscope. The external figure of the animal was that of a huge predatory fish, scaleless, but covered by a smooth or finely wrinkled skin, analogous to that of the whale tribe. The body of the animal is often found containing the food it had eaten just before its death; and its fæcal remains, in a petrified state, known as coprolites, not unfrequently retain the spiral marks of the animal's intestines. The Plesiosaurus (fig. 24), the contemporary of the previous saurian, possessed a lizard's head, a crocodile's teeth, a neck of extraordinary length, resembling the body of a serpent, a trunk and tail having the proportions of an ordinary quadruped, the ribs of a chameleon, and the paddles of a whale. It appears to have lived in shallow seas and estuaries, and to have breathed air like the ichthyosaurus and the modern whale. More than twenty species have been described. The Pterodactylus crassirostris (fig. 25) presents another of the strange forms of the period. This animal appears to have been suited equally to fly in the air and swim in the water. When first discovered, it was considered by some to be a bird, by others as a species of bat or a flying reptile. From the wing projected fingers, terminated by long hooks, like the curved claw on the thumb of the bat. The form of a single bone in this complex and anomalous structure enabled Cuvier conclusively to pronounce the creature to be a lizard. Eight species of the genus have been described, varying from the size of a snipe to that of a cormorant. In the Stonesfield slate, above the lias, the jaw-bones of several species of small insectivorous marsupial or pouched animals have been discovered, establishing the existence of the warm-blooded mammalian type at this early period. The jaw of one of these curious animals, namely, Phascolotherium Bucklandi, is represented in fig. 28. The oolitic beds, so named from the limestone consisting of small round concretionary bodies like the roe of a fish, abound with molluscs, such as pectens, oysters, and the lima, a species of which, inhabiting our present seas, is interesting as being a nest-building animal of an exquisitely beautiful appearance. The curiously angled Trigonia costata (fig. 26) is another of the same bivalve family, of which 100 species are known in the secondary rocks, and two are still living on the coast of South Australia. Terebratulæ or lamp-shells are still numerous amongst the declining class of brachiopods (figs. 27 and 30). Gasteropods, including the Patella or limpet genus, the Natica, and Purpuroidea or Purpurina (fig. 29), an extinct member of the great family of the whelks, occur in abundance in the inferior oolite. The Oxford clay, still higher in the series, is distinguished by the recurrence of many Ammonites and Belemnites (fig 31), the latter name being given to an extensive family of extinct cuttle-fishes of the secondary era. A belemnite was a chambered shell, allied in internal structure to that of the nautilus, but straight, and having the chambers inclosed in a cone-shaped fibrous sheath, the form of which resembled the point of an arrow, whence the name. Still higher in the series is the Portland limestone and sand, the formation which yielded the materials for erecting St. Paul's Cathedral, and many other public buildings. At Brora, in Sutherlandshire, the oolite contains a deposit of coal, corresponding with some of the coal-fields of India and of Richmond in Virginia. Some of the marine deposits contain impressions of sea-weeds; amongst terrestrial plants are many which seem to indicate a genial and warm climate during the oolitic period; such are various tree-ferns, plants having affinity to the agave, aloe, cycas, and zamia of the existing flora, palms and their allies, and coniferous trees. The Purbeck rocks, known as the "dirt-beds" of Portland, abound with loam-like strata, deposited from ancient vegetation, and intermingled with the roots and stems of fossil trees. The rocks consist of strata of fresh-water, brackish-water, and marine origin. The fresh-water shells of the different beds are represented by Physa (fig. 32), Unio (fig. 33), and Cyclas (fig. 34). The most important recent discovery in the rocks of the middle Purbeck, is that of the remains of many species of mammals, some marsupial and others placental, ranging from the size of a mouse to that of a hedgehog.

Cretaceous or Chalk System.—The oolites are succeeded in the ascending order by the rocks of the cretaceous system, at the basis of which are the fresh-water beds of the Wealden, including some estuary deposits, as may be inferred from the presence of a few specimens of marine shells. The species Paludina (fig. 35) and Cypris (36), besides others, are found in fresh-water beds sparingly interstratified with deposits containing the oyster and mussel. The Weald is more particularly distinguished by the occurrence of several remarkable extinct saurian reptiles, the Megalosaurus, Iguanodon, and Hyælosaurus, the skeletons of which, however, have not been found entire. The teeth of the iguanodon show it to have been an herbivorous animal, of gigantic bulk, the largest specimen discovered probably measuring 28 feet in length. The lower greensand, overlying the Wealden beds, is characterized by several groups of fossils, including various echinoderms or sea-urchins (Salenia punctata, fig. 37); a distinctive molluscan form is Perna mulleti (fig. 38). The Gault clay, underlying the upper cretaceous series, has also its peculiar group of sea-urchins, besides many crustaceans, molluscs, &c., generically although not specifically the same with those of the lower greensand. Amongst shells allied to the ammonite are Turrilites, a genus unknown in the lower rocks, and of a spiral form; also Hamites (H. rotundus, fig. 39), a straight shell, returning upon itself after a certain space, and forming a simple or complex hook. The chalk itself, from its familiar characters and uniformity of structure, is the most readily recognizable of all the British formations. Its organic remains are eminently marine, comprising numerous species of sponges, corals, star-fishes, sea-urchins, molluscs, crustaceans, fishes,

[1] Plinii Historia Naturalis, lib. ii. cap. 63.

lights up the volcano; but the earth, gentle and indulgent, ever subservient to the wants of man, spreads his walks with flowers, and his table with plenty; returns with interest every good committed to her care; and though she produces the poison, she still supplies the antidote; though constantly teazed more to furnish the luxuries of man than his necessities, yet even to the last, she continues her kind indulgence, and when life is over, she piously covers his remains in her bosom.

This external and fruitful layer which covers the earth, is, as was said, in a state of

---

and reptiles. Some obscure vestiges of mammalia and birds have also been detected. The chalk formation extends over an immense area in Europe and Asia, and in England it attains a thickness of 1200 feet. Flint nodules are widely dispersed through the series, in the upper more profusely than in the lower beds. These flints often exhibit a regular form, and in fact are found to be silicified sponges and other organisms. The system contains nearly 800 different species of animals, with traces of sea-weeds. Animals allied to the sea-urchin (echinoderms) are extremely abundant, of which Galerites (fig. 40) and Nucleolites (fig. 41) are examples. Connected with these are several genera of star-fishes, including an extinct and highly characteristic species, belonging to the existing genus Goniaster (G. Coombii, fig. 42). Numerous Rhynconellæ and Terebratulæ continue to represent the brachiopods (R. octoplicata, fig. 43), Turrilites (T. costatus, fig. 44), besides the Baculite, with its straight shell of the ammonite alliance, Scaphites (S. æqualis, fig. 45), with the shell lengthened out, and returning upon itself, and Belemnites. More than 80 species of fish are found in the chalk. Ten genera of reptiles are known, including a crocodile, a large marine reptile (Mososaurus) estimated to have been twenty-four feet long, the Plesiosaurus, the Ichthyosaurus, species of Pterodactyle, and several turtles likewise belong to the system.

KAINOZOIC OR TERTIARY, OR RECENT LIFE PERIOD.—*Eocene Group.*—The formations of the last great epoch in geology have been arranged into groups, in conformity with the gradual approximation of their fossils to generic and specific forms now living. The Eocene represents the dawn of existing life forms, and stands first, as being the most remote in the series. Its deposits in this country are contained in the two basins of London and Hampshire, and succeed the chalk in upward geological sequence. Fossils are found in abundance at Highgate, and in the Isle of Sheppey. In the latter locality, fossil fruits of tropical character, such as palms (Nipadites umbonatus, fig. 46), and other species, are of frequent occurrence. In beds succeeding the London clay a series of fossils, amounting to 200, have been detected. Many of the molluscs have a tropical aspect, such as forms of Cypræa and Murex. In the same set of rocks has been found a sea-serpent (Palæophis typhæus), twenty feet in length, a crocodile, sharks, and swordfish. The fluvio-marine deposits in Hampshire and the Isle of Wight yield a number of tropical species, such as Voluta spinosa (fig. 47), Fusus porrectus (fig. 48), Oliva Branderi (fig. 49), and Nummulites lævigata (fig. 50). The Nummulite, so called from its resemblance to a coin, is the shell of a primitive animal named Rhizopod, and consists of a series of chambers arranged in a spiral curve. Shells of a similar description were found, by the deep-sea soundings for the Atlantic telegraph, to cover the bed of the ocean at a depth of two miles. The brackish-water strata of the period under consideration, yield various species of shell-fish, and from the fresh-water beds are obtained Planorbis euomphalus (fig. 51), &c., besides land-shells of the snail tribe. Turtles, crocodiles, alligators, serpents, and several of the higher class of extinct mammals, as the Anoplotherium and Palæotherium, have been procured from the associated rocks. In strata superior to the foregoing, Paludina lenta (fig. 52), Limnæa longiscata (fig. 53), and several other fresh-water and brackish-water species are discovered. In regard to the proportion or percentage of shells of living species found in the tertiary deposits, and upon which Lyell has divided these formations into groups, the Eocene shows the least number. The proportions upon which the divisions are founded are as follows:—

Eocene, 3½ per cent. of living species.
Miocene, 18 per cent. of living species.
Pliocene, from 35 to 50 per cent. of living species.
Pleistocene, from 90 to 95 per cent. of living species.

Passing from the British Eocene deposits to those of France, it remains to be noticed that in the first great fresh-water formation of the period, in the neighbourhood of Paris, nearly fifty extinct species of mammalia were discovered and described by Cuvier, the greater number belonging to extinct genera of pachyderms or thick-hided animals, viz., Palæotherium, Anoplotherium, &c. The place of the Palæotherium is intermediate between the rhinoceros, the horse, and the tapir. Eleven or twelve species have been discovered, some as large as a rhinoceros, others varying in size from that of a horse to a hog. They are supposed to have lived and died on the margins of then existing rivers and lakes. Five species of Anoplotherium have been found in the neighbourhood of Paris. The largest was of the size of a small ass, with a thick tail, equal in length to its body, its probable use being to aid the animal in swimming. Another species was of the size and elegant proportions of a gazelle. The reconstruction of these extinct and then unknown animals by Cuvier, from a heap of mingled bones of different kinds of skeletons, is regarded as one of the most remarkable triumphs of inductive reasoning and comparative anatomy, and demonstrated the constancy of the law of the correlation of animal structures which pervades the whole of animated nature. The discovery in the same rocks of nine or ten extinct species of fossil birds, is another remarkable feature of the natural history of the Eocene period.

Miocene Group.—The rocks of this part of the tertiary are awanting in Great Britain, unless certain doubtful beds of vegetable remains in the island of Mull, at Antrim, and Bovey-Tracey may be regarded as belonging to them. The leaf-beds in Mull discovered by the Duke of Argyle, were assigned to the Miocene by the late Edward Forbes. The Miocene is extensively developed in France, where the remains of the elephant, rhinoceros, mastodon, hippopotamus, deer, bears, hyenas, and other quadrupeds, are found embedded in fresh-water strata, and in lava and showers of ashes, showing that the country had been subjected to volcanic action when these beds were deposited. In other districts the fossils are not less decidedly marine. The rocks of this period contain relics of the Dinotherium, a gigantic herbivorous animal, fifteen or eighteen feet long; Hippotherium, an animal allied to the horse; large cats, some of the size of a lion; musk-deer, a species of dog, and a monkey, the first fossil type of the order Quadrumana ever discovered. Miocene deposits exist on the Sewalik Hills, where they are of fresh-water origin, and have yielded extinct species of the elephant, dinotherium, mastodon, hippopotamus, camel, giraffe, sivatherium, monkeys, and tortoises of gigantic bulk.

continual change. Vegetables, which are naturally fixed and rooted to the same place, receive their adventitious nourishment from the surrounding earth and water; animals, which change from place to place, are supported by these, or by each other. Both, however, having for a time enjoyed a life adapted to their nature, give back to the earth those spoils, which they had borrowed for a very short space, yet still to be quickened again into fresh existence. But the deposits they make are of very dissimilar kinds, and the earth is very differently enriched by their continuance: those countries

---

Pliocene Group.—The most recent of all the marine stratified rocks is the Crag. It overlies the London clay, and is sometimes found resting on the chalk. It is rich in corals, and the quantity of shells contained in the ordinary red crag of Suffolk baffles all calculation. Of 260 species of shells, sixty now live in British seas. One of the more characteristic species is Fusus contrarius (fig. 54), still inhabiting our shores. In the same deposit are found the teeth of skates and sharks (tooth of Carcharadon megalodon, fig. 55); together with occasional vertebræ and other bones of whales, including ear-bones (fig. 56, ear-bone of Balæna emarginata), and numerous coprolites, the latter in such abundance that it constitutes a profitable business to separate these exuviæ from the crag on account of the phosphates they contain, and employ them in the manufacture of manure. The Norwich or Mammaliferous crag contains a large proportion of northern forms of shells, pointing to the existence of a colder climate during its deposition.

Pleistocene Group.—There are in this division a pre-glacial, a glacial, and a post-glacial period. It is supposed that during the first period the old sea-bed was sufficiently elevated to constitute dry land, probably continuous, from Britain to the Continent.—(Phillips.) Then followed a depression of the northern zones in Europe and America, the land sinking again to form a sea; hence, it is further conjectured, the precipitation of those great masses of diluvial, glacial, or boulder clays forming so striking a feature of the superficial deposits of Britain. To the pre-glacial period is ascribed the bone deposits in caves, containing elephant, hippopotamus, hyena, and other extinct species, and of which one of the most remarkable in England is Kirkdale Cave in Yorkshire. In the ossiferous caves of this country, thirty-seven species of mammalia have been discovered, of which number eighteen species are extinct. In the Kirkdale Cave were found bones of tigers, bears, wolves, elephants, rhinoceroses, &c., together with the remains of 300 hyenas. Similar caves are of frequent occurrence in other lands, and generally, as in this country, indicate the influence of local causes in their production. The plants of this period show a steady approximation to existing forms. The glacial period has formed a fertile source of speculation. Wherever geologists have explored the surface of Europe and America, great deposits of gravel, sand, and clay, containing portions of all the known rocks and strata, lie spread over the surface of the country, covering rocks of every age. In Britain the boulder drift is spread over all the lower parts of Scotland and Ireland, and in England and Wales, many of the so-called erratic blocks being of granite, and of kinds showing that they must have been transported from Cumberland and Scotland. From the nature of the detritus deposited upon the hill-sides in the Highlands of Scotland, and in the north of England and Ireland, it is inferred that the whole country must have been submerged, when the drifted materials were accumulated, to a depth of 1500, and even 2000 or 2300 feet below its present level. Previous to this submergence, the general relations of mountains and valleys are believed to have been the same as exist at the present time. The depression of the land, taking place at different times, was followed by incursions of the sea, producing terraces by its denuding or abrading action upon its shores. In our latitudes, icebergs drifting from the north, laden with masses of rock and soil, grated along the rocky floors, smoothing their surfaces, and marking them with grooves and scratches, similar to those produced by terrestrial glaciers in the existing age.—(Ramsay.) Glaciers appear also to have been formed on many of the Highland and Welsh mountains, then forming groups of islands, and from which they descended to the sea, and floated away as icebergs, precipitating, as they dissolved, those masses of earth and rocky fragments now dispersed over the Lowlands of Scotland, England, and Wales. The existence of ice in the form of glaciers and floating bergs, and the prevalence of a frigid temperature, during the drift period, is inferred not only from the accumulation of detritus on hill-sides and in valleys, and from the polishing and furrowing of the rocks—appearances identical with the effects produced at the present time by the glaciers of the Alps—but also from the indubitably *arctic* character of the shells embedded in the drift deposits, many of the species being now found alive only in extreme northern latitudes. It is proved also, by observations made over a large portion of the European and American continents, that the most general direction of the drift currents was from north to south, or from north-west to south-east, implying considerable local displacements, or some general changes of level in the northern zones, whereby the reciprocal currents from the equator and the arctic basin may have been diverted into different channels from those in which they now flow. The evidence of ancient glaciers in the British isles derives additional force from the existence in all the greater valleys of the Scottish Highlands, Wales, and Ireland, of deposits of gravel, such as fringe the borders and accumulate at the lower extremity of a modern glacier, and are known by the name of lateral and terminal moraines. The formation of these deposits during the drift period is ascribed to the descent of the ice towards the sea, as the land was gradually elevated to its present level. The grooves of the rocks are frequently obliterated by atmospheric action, where the traces of the descending glacier are manifest in rounded surfaces, called *roches moutonnées*, sometimes occurring in small knolls, at other times of greater magnitude. One of the most striking instances of this effect of glacial force is seen at Loch Scavaig, at the mouth of Loch Coruisk, in Skye, where the enduring hypersthene rock of the Cuchullin Hills retains the furrows and rounded surfaces produced by the descent of ice, in all their primitive freshness. In the upper beds of the drift are found the remains of the Elephas primigenius (fig. 57) or Mammoth, which is better known than most other extinct animals, from the discovery of an entire specimen preserved in the frozen soil of a cliff at the mouth of the river Lena in Siberia, and now preserved at St. Petersburg. These huge elephants were fitted by their peculiar woolly covering for living in a cold climate. The remains of this species are widely dispersed in this country, and through Europe, Asia, and North America. The beds referred to also contain relics of the rhinoceros, the musk-deer, rein-deer, &c. Some of the mammalia of the pre-glacial period seem to have survived the changes that then took place in the physical and vital conditions of our northern zones, and retreating for a time, reappeared in the post-glacial, that have for a long time supported men and other animals, having been observed to become every day more barren; while, on the contrary, those desolate places, in which vegetables only are abundantly produced, are known to be possessed of amazing fertility. "In regions which are uninhabited,"[1] says Mr. Buffon, "where the forests are not cut down, and where animals do not feed upon the plants, the bed of vegetable earth is constantly increasing. In all woods, and even in those which are often cut, there is a layer of earth of six or eight inches thick, which has been formed by the leaves, branches, and bark, which fall and rot upon the ground. I have frequently observed on a Roman way, which crosses Burgundy, for a long extent, that there is a bed of black earth, of more than a foot thick, gathered over the stony pavement, on which several trees, of a very considerable size, are supported. This I have found to be nothing else than an earth formed by decayed leaves and branches, which have been converted by time into a black soil. Now as vegetables draw much more of their nourishment from the air and water than they do from the earth, it must follow that in rotting upon the ground, they must give more to the soil than they have taken from it. Hence, therefore, in woods kept a long time without cutting, the soil below increases to a considerable depth; and such we actually find the soil in those American wilds, where the forests have been undisturbed for ages. But it is otherwise where men and animals have long subsisted: for as they make a considerable consumption of wood and plants, both for firing and other uses, they take more from the earth than they return to it; it follows, therefore, that the bed of vegetable earth, in an inhabited country, must be always diminishing; and must at length resemble the soil of Arabia Petrea, and other provinces of the East, which having been long inhabited, are now become plains of salt and sand; the fixed salt always remaining, while the other volatile parts have flown away."

If from this external surface we descend deeper, and view the earth cut perpendicularly downwards, either in the banks of great rivers, or steepy sea-shores, or going still deeper, if we observe it in quarries or mines, we shall find its layers regularly disposed in their proper order. We must not expect, however, to find them of the same kind or thickness in every place, as they differ in different soils or situations. Sometimes marl is seen to be over sand, and sometimes under it. The most common disposition is, that under the first earth is found gravel or sand, then clay or marl, then chalk or coal, marbles, ores, sands, gravels; and thus an alteration of these substances, each growing more dense as it sinks deeper. The clay, for instance, found at the depth of a hundred feet, is usually more heavy than that found not far from the surface. In a well which was dug

---

along with new species, in the territories peopled by their ancestors, Britain being not then severed from the Continent. These inhabited the land along with the Irish elk (Megaceros hibernicus, fig. 58), an extinct species, remarkable for its gigantic size and the great relative magnitude and noble form of its antlers. It was, according to Owen, not an elk, but a true deer, intermediate between the fallow and the rein deer, and although its remains are most abundant in Ireland, they are found also in Scotland, England, and France. Amongst its contemporaries were the reindeer, oxen, beavers, bears, wolves, &c. The Mastodon, allied to the elephant, has left its remains both in the Miocene and Pleistocene deposits. To the same period belongs the Megatherium, a huge extinct species of sloth, which has left its remains chiefly in the southern regions of America. A skeleton now in the British Museum measures eighteen feet in length. In New Zealand have been discovered the bones of a gigantic bird, to which Owen gave the name of Dinornis, and which appears to have become extinct within a comparatively recent period. Another bird, the Dodo, has become extinct in the island of Mauritius within the last two centuries. The great auk seems to be rapidly verging towards extinction. It remains only to be noted, that all the changes referred to within the tertiary period appear to have been accompanied by oscillations of level, modifying the previous relation of land and water, and attended by the destruction of old, and the introduction of new species of animals and plants. Amongst the latest geological phenomena belonging to the past, is the elevation of the land, forming the terraced or raised beach distinctly seen on all our sea-shores, and on the banks of salt-water lochs. The shells in these beaches are all of recent species. On the shores of Norway and Sweden, a process of elevation has been perceptible for a century and a half.

No traces of the remains of man or of his works have been discovered in any of the formations which mark the epochs of geological time, not even in those later deposits where the forms of animals and plants approximate most closely to existing species. The discovery, in a few instances, in comparatively superficial deposits, of human bones and other indications of the presence and the arts of man, are referable to accidental and explainable causes. Fragments of pottery found deeply embedded in the mud of the Nile have been supposed to point to a more remote origin of the human race than is assigned to it in the usually accepted chronology; but the observation has been proved to proceed upon calculations of the rate of precipitation, founded upon no ascertained knowledge of the time required, even in the most simple conditions, for the deposit of a foot or a fathom of river silt. The occurrence of flint arrowheads and hatchets in diluvial gravel at Abbeville and Amiens in France, has been found (1860) by one of the most experienced of modern geologists (Professor Rogers), to involve conditions which render it extremely doubtful whether they belong to the remote period ascribed to them. From the discovery in England of flint weapons mingled with the remains of the cave bear and rhinoceros, the inference becomes rational and probable, not that the human family belongs to a higher antiquity, but that these and other extinct animals existed in this country to a later period than is generally supposed.

[1] Buffon, vol. i. p. 353.

at Amsterdam, to the depth of two hundred and thirty feet, the following substances were found in succession:[1] seven feet of vegetable earth, nine of turf, nine of soft clay, eight of sand, four of earth, ten of clay, four of earth, ten of sand, two of clay, four of white sand, one of soft earth, fourteen of sand, eight of clay mixed with sand, four of sea-sand mixed with shells, then a hundred and two feet of soft clay, and then thirty-one feet of sand.

In a well dug at Marly, to the depth of a hundred feet, Mr. Buffon gives us a still more exact enumeration of its layers of earth. "Thirteen of a reddish gravel, two of gravel mingled with a vitrifiable sand, three of mud or slime, two of marl, four of marly stone, five of marl in dust mixed with vitrifiable sand, six of very fine vitrifiable sand, three of earthy marl, three of hard marl, one of gravel, one of eglantine, a stone of the hardness and grain of marble, one of gravelly marl, one of stony marl, one of a coarser kind of stony marl, two of a coarser kind still, one of vitrifiable sand mixed with fossil-shells, two of fine gravel, three of stony marl, one of coarse powdered marl, one of stone calcinable like marble, three of gray sand, two of white sand, one of red sand streaked with white, eight of gray sand with shells, three of very fine sand, three of a hard gray stone, four of red sand streaked with white, three of white sand, and fifteen of reddish vitrifiable sand."

In this manner the earth is everywhere found in beds over beds; and, what is still remarkable, each of them, as far as it extends, always maintains exactly the same thickness. It is found also, that as we proceed to considerable depths, every layer grows thicker. Thus in the adduced instances we might have observed, that the last layer was fifteen feet thick, while most of the others were not above eight; and this might have gone much deeper, for aught we can tell, as before they got through it the workmen ceased digging.

These layers are sometimes very extensive, and often are found to spread over a space of some leagues in circumference. But it must not be supposed that they are uniformly continued over the whole globe without any interruption; on the contrary, they are ever at small intervals, cracked through as it were by perpendicular fissures: the earth resembling, in this respect, the muddy bottom of a pond, from whence the water has been dried off by the sun, and thus gaping in several chinks, which descend in a direction perpendicular to its surface. These fissures are many times found empty, but oftener closed up with adventitious substances that the rain, or some other accidental causes, have conveyed to fill their cavities. Their openings are not less different than their contents, some being not above half an inch wide, some a foot, and some several hundred yards asunder. Which last form those dreadful chasms that are to be found in the Alps, at the edge of which the traveller stands dreading to look down at the immeasurable gulf below. These amazing clefts are well known to such as have passed these mountains, where a chasm frequently presents itself several hundred feet deep, and as many over, at the edge of which the way lies. It often happens also, that the road leads along the bottom, and then the spectator observes on each side frightful precipices several hundred yards above him; the sides of which correspond so exactly with each other, they evidently seem torn asunder.

But these chasms, to be found in the Alps, are nothing to what Ovale tells us are to be seen in the Andes. These amazing mountains, in comparison of which the former are but little hills, have their fissures in proportion to their greatness. In some places they are a mile wide, and deep in proportion; and there are some others, that, running under ground, in extent resemble a province.

Of this kind also is that cavern called *Eldenhole*, in Derbyshire, which Dr. Plott tells us, was sounded by a line of eight and twenty hundred feet, without finding the bottom or meeting with water: and yet the mouth at the top is not above forty yards over.[2] This immeasurable cavern runs perpendicularly downward; and the sides of it seem to tally so plainly as to show that they were once united. Those who come to visit the place, generally procure stones to be thrown into its mouth; and these are heard for several minutes, falling and striking against the sides of the cavern, producing a sound that resembles distant thunder, dying away as the stone goes deeper.[3]

Of this kind also is that dreadful cavern described by Elian; his account of which the reader may not have met with.[4] "In the country of the Arrian Indians, is to be seen an amazing chasm, which is called *The Gulph of Pluto*. The depth and the recesses of this horrid place are as extensive as they are unknown. Neither the natives, nor the curious who visit it, are able to tell how it was first made, or to what depths it descends. The Indians continually drive thither great multitudes of animals, more than three thousand at a time, of different kinds, sheep, horses, and goats; and, with an absurd superstition, force them into the cavity, from whence they never return. Their several sounds, however, are heard as they descend; the bleating of sheep, the lowing of oxen, and the neighing of horses, issuing up to the mouth of the cavern. Nor do these sounds cease, as the place is continually furnished with a fresh supply."

---

[1] Varenius, as quoted by Mr. Buffon, p. 358.

[2] Phil. Trans. vol. ii. p. 370.

[3] Dr. Plott has exaggerated the width and depth of this fearful cavern. Mr. Lloyd, who descended into it, found its depth to be 186 feet. Its mouth is 20 feet wide one way, and 50 another. He found it to consist of two compartments: the first was in shape like an oven, the other resembled the dome of a glass-house furnace. Mr. Lloyd says, from its roof were hanging stalactites, from which circumstance we may conclude, that it occurs in a limestone rock.

[4] Æliani Var. Hist. lib. xvi. cap. 16.

There are many more of these dreadful perpendicular fissures in different parts of the earth; with accounts of which, Kircher, Gaffarellus, and others who have given histories of the wonders of the subterranean world, abundantly supply us. The generality of readers, however, will consider them with less astonishment when they are informed of their being common all over the earth; that in every field, and every quarry, these perpendicular fissures are to be found, either still gaping, or filled with matter that has accidently closed their interstices. The inattentive spectator neglects the inquiry, but their being common is partly the cause that excites the philosopher's attention to them: the irregularities of nature he is often content to let pass unexamined; but when a constant and a common appearance presents itself, every return of the object is a fresh call to his curiosity; and the chink in the next quarry becomes as great a matter of wonder as the chasm in Eldenhole. Philosophers have long, therefore, endeavoured to find out the cause of these perpendicular fissures, which our own countrymen, Woodward and Ray, were the first that found to be so common and universal. Mr. Buffon supposes them to be cracks made by the sun, in drying up the earth, immediately after its immersion from the deep. The heat of the sun is very probably a principal cause; but it is not right to ascribe to one only, what we find may be the result of many. Earthquakes, severe frosts, bursting waters, and storms tearing up the roots of trees, have, in our own times, produced them; and to this variety of causes we must, at present, be content to assign those that have happened before we had opportunities for observation.

CHAP. VII.

OF CAVES AND SUBTERRANEOUS PASSAGES THAT SINK, BUT NOT PERPENDICULARLY, INTO THE EARTH.

In surveying the subterranean wonders of the globe, besides those fissures that descend perpendicularly, we frequently find others that descend but a little way, and then spread themselves often to a great extent below the surface. Many of these caverns, it must be confessed, may be the production of art and human industry: retreats made to protect the oppressed, or shelter the spoiler. The famous labyrinth of Candia, for instance, is supposed to be entirely the work of art. Mr. Tournefort assures us that it bears the impression of human industry, and that great pains have been bestowed upon its formation. The stone-quarry of Mæstricht is evidently made by labour: carts enter at its mouth, and load within, then return, and discharge their freight into boats that lie on the brink of the river Mæse. This quarry is so large, that forty thousand people may take shelter in it: and it in general serves for this purpose, when armies march that way; becoming then an impregnable retreat to the people that live thereabout. Nothing can be more beautiful than this cavern, when lighted up with torches: for there are thousands of square pillars, in large level walks, about twenty feet high; and all wrought with much neatness and regularity. In this vast grotto there is very little rubbish; which shows both the goodness of the stone and the carefulness of the workmen. To add to its beauty, there also are in various parts of it, little pools of water, for the convenience of the men and cattle. It is remarkable also, that no droppings are seen to fall from the roof, nor are the walks any way wet under foot, except in cases of great rains, where the water gets in by the air-shafts.[1] The salt mines in Poland are still more spacious than these. Some of the catacombs, both in Egypt and Italy, are said to be very extensive. But no part of the world has a greater number of artificial caverns than Spain, which were made to serve as retreats to the Christians against the fury of the Moors, when the latter conquered that country. However, an account of the works of art does not properly belong to a natural history. It will be enough to observe, that though caverns be found in every country, far the greatest part of them have been fashioned by the hand of nature only. Their size is found beyond the power of man to have effected, and their forms but ill adapted to the conveniences of a human habitation. In some places indeed, we find mankind still make use of them as houses; particularly in those countries where the climate is very severe; but in general they are deserted by every race of meaner animals, except the bat; these nocturnal solitary creatures are usually the only inhabitants; and these only in such whose descent is sloping, or, at least, not directly perpendicular.

---

[1] Phil. Trans. vol. ii. p. 363.

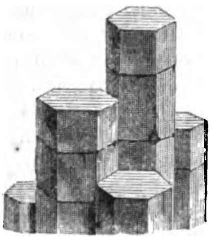
There is scarcely a country in the world without its natural caverns; and many new ones are discovered every day. Of those in England, Oakley-hole, the Devil's-hole, and Penpark-hole, have been often described. The former, which lies on the south side of Mendip-hills, within a mile of the town of Wells, is much resorted to by travellers. To conceive a just idea of this, we must imagine a precipice of more than a hundred yards high, on the side of a mountain which shelves away a mile above it. In this is an opening not very large, into which you enter, going along upon a rocky uneven pavement, sometimes ascending, and sometimes descending. The roof of it, as you advance, grows higher; and in some places is fifty feet from the floor. In some places, however, it is so low that a man must stoop to pass. It extends itself, in length, about two hundred yards: and from every part of the roof and the floor there are formed sparry concretions of various figures, that by strong imaginations have been likened to men, lions, and organs. At the farthest part of this cavern rises a stream of water, well stored with fish, large enough to turn a mill, and which discharges itself near the entrance.

Penpark-hole, in Gloucestershire, is almost as remarkable as the former. Captain Sturmy descended into this by a rope, twenty-five fathoms perpendicular, and at the bottom found a very large vault in the shape of a horse-shoe. The floors consisted of a kind of white stone enamelled with lead ore, and the pendant rocks were glazed with spar. Walking forward on this stony pavement, for some time, he came to a great river, twenty fathoms broad, and eight fathoms deep; and having been informed that it ebbed and flowed with the sea, he remained in this gloomy abode for five hours to make an exact observation. He did not find however, any alteration whatsoever in its appearance. But his curiosity was ill requited; for it cost this unfortunate gentleman his life; immediately after his return he was seized with an unusual and violent headache, which threw him into a fever, of which he died soon after.[1]

But of all the subterranean caverns now known, the grotto of Antiparos is the most remarkable, as well for its extent as for the beauty of its sparry incrustations. This celebrated cavern was first discovered by one Magni, an Italian traveller, about a hundred

---

[1] There are other caves in Great Britain, fully as remarkable as those above described. The island of Staffa, on the north-west coast of Scotland, presents, perhaps, the most magnificent of the kind in existence. It was first described as follows, by Sir Joseph Banks, in a communication to Mr. Pennant. "We were no sooner arrived," says Sir Joseph, "than we were struck with a scene of magnificence which exceeded our expectations, though founded, as we thought, on the most sanguine foundation. The whole of that island, a mile in length, and half a mile in breadth; supported by ranges of natural pillars, mostly above 50 feet high, every stone being formed into a certain number of sides and angles, standing in natural colonnades, according as the bays or points of land formed themselves; upon a firm basis of solid unformed rock; above these the stratum which reaches to the soil or surface of the island, varied in thickness as the island itself is formed into hills or valleys, each hill, which hung over the columns below, forming an ample pediment; some of these above sixty feet in thickness, from the base to the point, formed by the sloping of the hill on one side almost in the shape of those used in architecture. Compared with this what are the cathedrals or palaces built by man? Mere models or playthings; imitations as diminutive as his works will always be, when compared to those of nature. Where is now the boast of the architect? Regularity, the only part in which he fancied himself to exceed his mistress, Nature, is here found in her possession; and here it has been for ages undescribed. Is not this the school where the art was originally studied? and what has been added to this by the whole *Grecian* school? A capital to ornament the column of nature, of which they could expect only a model; and for that very capital they were obliged to a bush of *Acanthus:* how amply does nature repay those who study her wonderful works! With our minds full of such reflections, we proceeded along the shore, treading upon another *Giant's Causeway*, every stone being regularly formed into a certain number of sides and angles, till in a short time we arrive at the mouth of a cave, the most magnificent, I suppose, that has ever been described by travellers. The mind can hardly form an idea more magnificent than such a space supported on each side by ranges of columns, and roofed by the bottoms of those which have been broken off in order to form it; between the angles of which a yellow stalagmitic matter has been exuded, which serves to define the angles precisely, and at the same time vary the colour with a great deal of elegance; and to render it still more agreeable, the whole is lighted from without, so that the farthest extremity is very plainly seen from without; and the air, being agitated by the flux and reflux of the tides, is perfectly dry and wholesome, free entirely from the damp vapour with which natural caverns in general abound. We asked the name of it. Said our guide, 'The cave of *Fhinn.*' 'What is *Fhinn?*' said we. '*Fhinn Mac Coul*, whom the translator of *Ossian's* work has called Fingal.' How fortunate, that in this case we should meet with the remembrance of that chief, whose existence, as well as



Columnar Basalt.

years ago, at Antiparos, an inconsiderable island of the Archipelago.[1] The account he gives of it is long and inflated, but upon the whole amusing. "Having been informed," says he, "by the natives of Paros, that in the little island of Antiparos, which lies about two miles from the former, of a gigantic statue that was to be seen at the mouth of a cavern in that place, it was resolved that we (the French consul and himself) should pay it a visit. In pursuance of this resolution, after we had landed on the island, and walked about four miles through the midst of beautiful plains and sloping woodlands, we at length came to a little hill, on the side of which yawned a most horrid cavern, that with its gloom at first struck us with terror, and almost repressed curiosity. Recovering the first surprise, however, we entered boldly; and had not proceeded above twenty paces, when the supposed statue of the giant presented itself to our view. We quickly perceived, that what the ignorant natives had been terrified at as a giant was nothing more than a sparry concretion, formed by the water dropping from the roof of the cave, and by degrees hardening into a figure that their fears had formed into a monster. Incited by this extraordinary appearance, we were induced to proceed still farther, in quest of new adventures in the subterranean abode. As we proceeded, new wonders offered themselves: the spars, formed into trees and shrubs, presented a kind of petrified grove; some white, some green; and all receding in due perspective. They struck us with the more amazement, as we knew them to be mere productions of nature, who, hitherto in solitude, had, in her playful moments, dressed the scene as if for her own amusement.

"But we had as yet seen but a few of the wonders of the place; and were introduced only into the portico of this amazing temple. In one corner of this half-illumined recess there appeared an opening of about three feet wide, which seemed to lead to a place totally dark, and that, one of the natives assured us, contained nothing more than a reservoir of water. Upon this we tried, by throwing down some stones, which rumbling along the sides of the descent for some time, the sound seemed at last quashed in a bed of water. In order, however, to be more certain, we sent in a Levantine mariner, who, by the promise of a good reward, with a flambeau in his hand, ventured into this narrow aperture. After continuing within it for about a quarter of an hour, he returned carrying some beautiful pieces of white spar in his hand, which art could neither imitate nor equal. Upon being informed by him that the place was full of these beautiful incrustations, I ventured in once more with him for about fifty paces, anxiously and cautiously descending by a steep and dangerous way. Finding, however, that we came to a precipice which led into a spacious amphitheatre, if I may so call it, still deeper than any other part, we returned, and being provided with a ladder, flambeaux, and other things to expedite our descent, our whole company, man by man, ventured into the same opening, and descending one after another, we at last saw ourselves altogether in the most magnificent part of the cavern.

"Our candles being now all lighted up, and the whole place completely illuminated, never could the eye be presented with a more glittering, or a more magnificent scene. The roof all hung with solid icicles, transparent as glass, yet solid as marble. The eye could scarcely reach the lofty and noble ceiling; the sides were regularly formed with spars; and the whole presented the idea of a magnificent theatre, illuminated with an immense profusion of lights. The floor consisted of solid marble; and in several places magnificent columns, thrones, altars, and other objects appeared, as if nature had designed to mock the curiosities of art. Our voices, upon speaking or singing, were redoubled to an astonishing loudness, and upon the firing of a gun, the noise and reverberations were almost deafening. In the midst of this grand amphitheatre rose a concretion of about

---

that of the whole *Epic* poem, is almost doubted in England.

The following are the dimensions of the cave:—

Length of the cave from the arch without,	371	feet.
From the pitch of the arch, . . .	250	„
Breadth of the arch at the mouth, . .	53	„
At the farther end, ...	20	„
Height of the arch at the mouth, . .	117	„
Height of the arch at the end, . .	79	„
Height of an outside pillar, ...	89	„
Of one at the north-west corner, . .	54	„
Depth of the water at the mouth, . .	18	„
At the bottom, ...	9	„

In volcanic regions there are many caves, formed by the blisters of the lava, which flows during the eruption of volcanic mountains. The following is a description of one of that kind by Sir George M‘Kenzie, which he met with during his travels in Iceland, in the year 1810, in a valley near Havneoird. "We proceeded to a cave (says Sir George), about two miles to the eastward. It was nothing more than an extensive hollow, formed by one of those blisters or bubbles, hundreds of which we have walked over. Many of these are of considerable depth and great length. The bottom of this was covered with ice, and numerous icicles hung from the roof. Having lighted our lamps, we went to the end of the cave, the distance of which, from the entrance, we found to be fifty-five yards, the height not being in general more than seven or eight feet. The inside was lined with melted matter disposed in various singular forms."

[1] Kircher Mund. sub. 112. I have translated a part of Kircher's description, rather than Tournefort's, as the latter was written to support an hypothesis.

fifteen feet high, that in some measure resembled an altar; from which, taking the hint, we caused mass to be celebrated there. The beautiful columns that shot up round the altar appeared like candlesticks; and many other natural objects represented the customary ornaments of this sacrament.

"Below even this spacious grotto there seemed another cavern; down which I ventured with my former mariner, and descended about fifty paces by means of a rope. I at last arrived at a small spot of level ground, where the bottom appeared different from that of the amphitheatre, being composed of a soft clay yielding to the pressure, and in which I thrust a stick to about six feet deep. In this, however, as above, numbers of the most beautiful crystals were formed, one of which particularly resembled a table. Upon our egress from this amazing cavern, we perceived a Greek inscription upon a rock at the mouth, but so obliterated by time that we could not read it. It seemed to import that one Antipater, in the time of Alexander, had come thither, but whether he penetrated into the depths of the cavern, he does not think fit to inform us."

Such is the account of this beautiful scene as communicated in a letter to Kircher. We have another, and a more copious description of it by Tournefort, which is in everybody's hands; but I have given the above, both because it was communicated by the first discoverer, and because it is a simple narrative of facts, without any reasoning upon them. According to Tournefort's account, indeed, we might conclude from the rapid growth of the spars in this grotto that it must every year be growing narrower, and that it must in time be choked up with them entirely; but no such thing has happened hitherto, and the grotto at this day continues as spacious as we ever knew it.

This is not a place for an inquiry into the seeming vegetation of those stony substances, with which this and almost every cavern are incrusted; it is enough to observe, in general, that they are formed by an accumulation of that little gritty matter which is carried thither by the waters, and which in time acquires the hardness of marble. What in this place more imports us to know, is how these amazing hollows in the earth came to be formed. And I think, in the three instances above mentioned, it is pretty evident, that their excavation has been owing to water. These finding subterraneous passages under the earth, and by long degrees hollowing the beds in which they flowed, the ground above them has slipped down closer to their surface, leaving the upper layers of the earth or stone still suspended: the ground that sinks upon the face of the waters forming the floor of the cavern; the ground or rock, that keeps suspended, forming the roof: and indeed, there are but few of these caverns found without water, either within them, or near enough to point out their formation.

CHAP. VIII.

OF MINES, DAMPS, AND MINERAL VAPOURS.

The caverns which we have been describing, generally carry us but a very little way below the surface of the earth. Two hundred feet, at the utmost, is as much as the lowest of them is found to sink. The perpendicular fissures run much deeper; but few persons have been bold enough to venture down to their deepest recesses; and some few who have tried have been able to bring back no tidings of the place, for unfortunately they left their lives below. The excavations of art have conducted us much farther into the bowels of the globe. Some mines in Hungary are known to be a thousand yards perpendicular downwards; and I have been informed by good authority, of a coal mine in the north of England, a hundred yards deeper still.

It is beside our present purpose to inquire into the peculiar contrivance and construction of these, which more properly belongs to the history of fossils. It will be sufficient to observe in this place, that as we descend into the mines, the various layers of earth are seen as we have already described them; and in some of these are always found the metals or minerals for which the mine has been dug. Thus frequently gold is found dispersed and mixed with clay and gravel;[1] sometimes it is mingled with other metallic bodies, stones, or bitumens;[2] and sometimes united with that most obstinate of all substances, platina, from which scarce any art can separate it. Silver is sometimes found quite pure,[3] sometimes mixed with other substances and minerals. Copper is found in beds mixed with various substances, marbles, sulphurs, and pyrites. Tin, the ore of which is heavier than that of any other metal, is generally found mixed with every kind of matter:[4] lead is also equally common: and iron, we well know, can be extracted from all the substances upon earth.

---

[1] Ulloa, vol. ii. p. 470.
[2] Ibid.
[3] Macquer's Chemistry, p. 316.
[4] Hill's Fossils, p. 628.

The variety of substances which are thus found in the bowels of the earth, in their native state, have a very different appearance from what they are afterwards taught to assume by human industry. The richest metals are very often less glittering and splendid than the most useless marcasites; and the basest ores are generally the most beautiful to the eye.

This variety of substances, which compose the internal parts of our globe, is productive of equal varieties, both above and below its surface. The combination of the different minerals with each other, the heats which arise from their mixture, the vapours they diffuse, the fires which they generate, or the colds which they sometimes produce, are all either noxious or salutary to man; so that in this great elaboratory of nature, a thousand benefits and calamities are forging, of which we are wholly unconscious; and it is happy for us that we are so.

Upon our descent into mines of considerable depth, the cold seems to increase from the mouth as we descend;[1] but after passing very low down, we begin by degrees to come into a warmer air, which sensibly grows hotter as we go deeper, till at last, the labourers can scarcely bear any covering as they continue working.

This difference in the air was supposed by Boyle to proceed from magazines of fire that lay nearer the centre, and that diffused their heat to the adjacent regions. But we now know that it may be ascribed to more obvious causes. In some mines, the composition of the earth all around is of such a nature, that upon the admission of water or air, it frequently becomes hot, and often bursts out into eruptions. Besides this, as the external air cannot readily reach the bottom, or be renewed there, an observable heat is perceived below, without the necessity of recurring to the central heat for an explanation.

Hence, therefore, there are two principal causes of the warmth at the bottom of mines: the heat of the substances of which the sides are composed; and the want of renovation in the air below. Any sulphureous substance, mixed with iron, produces a very great heat, by the admission of water. If, for instance, a quantity of sulphur be mixed with a proportionable share of iron filings, and both kneaded together into a soft paste, with water, they will soon grow hot, and at last produce a flame. This experiment, produced by art, is very commonly effected within the bowels of the earth by nature. Sulphurs and irons are intimately blended together, and want only the mixture of water or air to excite their heat; and this, when once raised, is communicated to all bodies that lie within the sphere of their operation. Those beautiful minerals called *marcasites* and *pyrites*, are often of this composition; and wherever they are found, either by imbibing the moisture of the air, or having been by any means combined with water, they render the mine considerably hot.[2]

The want of fresh air also, at these depths, is, as we have said, another reason for their being found much hotter. Indeed, without the assistance of art, the bottom of most mines would, from this cause, be insupportable. To remedy this inconvenience, the miners are often obliged to sink, at some convenient distance from the mouth of the pit where they are at work, another pit, which joins the former below, and which, in Derbyshire, is called an *air-shaft*. Through this the air circulates; and thus the workmen are enabled to breathe freely at the bottom of the place; which becomes, as Mr. Boyle affirms, very commodious for respiration, and also very temperate as to heat and cold.[3] Mr. Locke, however, who has left us an account of the Mendip mines, seems to present a different picture. "The descent into these is exceedingly difficult and dangerous; for they are not sunk like wells, perpendicularly, but as the crannies of the rocks happen to run. The constant method is to swing down by a rope placed under the arms, and clamber along by applying both feet and hands to the sides of the narrow passage. The air is conveyed into them through a little passage that runs along the sides from the top, where they set up some turfs, on the lee-side of the hole, to catch and force it down. These turfs being removed to the windy side, or laid over the mouth of the hole, the miners below presently want breath, and faint; and if sweet-smelling flowers chance to be placed there, they immediately lose their fragrancy, and stink like carrion." An air so putrefying can never be very commodious for respiration.

Indeed, if we examine the complexion of most miners, we shall be very well able to form a judgment of the unwholesomeness of the place where they are confined. Their pale and sallow looks show how much the air is damaged by passing through those deep and winding ways, that are rendered humid by damps, or warmed with noxious exhalations. But although every mine is unwholesome, all are not equally so. Coal-mines are generally less noxious than those of tin; tin than those of copper; but none are so dreadfully destructive as those of quicksilver. At the mines near the village of Idra, nothing can adequately describe the deplorable infirmities of such as fill the hospital there; emaciated and crippled, every limb contracted or convulsed, and some in a manner transpiring quicksilver at every pore. There was one man, says Dr. Pope,[1] who was not in the mines above half a year, and yet whose body was so impregnated with this mineral, that putting a piece of brass money in his mouth, or rubbing it between his fingers, it immediately became as white as if it had been washed over with quicksilver. In this manner all the workmen are killed sooner or later; first becoming paralytic, and then dying consumptive: and all this they sustain for the trifling reward of sevenpence a day.

---

[1] Boyle, vol. iii. p. 232.

[2] Kircher Mund. Subt. vol. ii. p. 216.

[3] Boyle, vol. iii. p. 238.

But these metallic mines are not so noxious from their own vapours, as from those of the substances with which the ores are usually united, such as arsenic, cinnabar, bitumen, or vitriol. From the fumes of these, variously combined, and kept inclosed, are produced those various damps, that put on so many dreadful forms, and are usually so fatal. Sometimes these noxious vapours are perceived by the delightful fragrance of their smell,[2] somewhat resembling the pea-blossom in bloom, from whence one kind of damp has its name. The miners are not deceived, however, by its flattering appearances; but as they have thus timely notice of its coming, they avoid it while it continues, which is generally during the whole summer season. Another shows its approach by the burning of the candles, which seem to collect their flame into a globe of light, and thus gradually lessen, till they are quite extinguished. From this, also, the miners frequently escape; however, such as have the misfortune to be caught in it, either swoon away, and are suffocated, or slowly recover in excessive agonies. Here also is a third, called *the fulminating damp*, much more dangerous than either of the former, as it strikes down all before it like a flash of gunpowder, without giving any warning of its approach. But there is another, more deadly than all the rest, which is found in those places where the vapour has been long confined, and has been, by some accident, set free. The air rushing out from thence, always goes upon deadly errands: and scarce any escape to describe the symptoms of its operations.

Some colliers in Scotland, working near an old mine that had been long closed up, happened, inadvertently, to open a hole into it, from the pit where they were then employed. By great good fortune, they at that time perceived their error, and instantly fled for their lives. The next day, however, they were resolved to renew their work in the same pit, and eight of them ventured down, without any great apprehensions; but they had scarcely got to the bottom of the stairs that led to the pit, but, coming within the vapour, they all instantly dropped down dead, as if they had been shot. Amongst these unfortunate poor men, there was one whose wife was informed he was stifled in the mine: and, as he happened to be next the entrance, she so far ventured down as to see where he lay. As she approached the place, the sight of her husband inspired her with a desire to rescue him, if possible, from that dreadful situation; though a little reflection might have shown her it was then too late. But nothing could deter her; she ventured forward, and had scarce touched him with her hand, when the damp prevailed, and the misguided, but faithful creature, fell dead by his side.[3]

---

[1] Phil. Trans. vol. ii. p. 578.

[2] Ibid. p. 375.

[3] The mode of working coal-mines varies in different parts of the country, partly on account of the situation of the seams of coal in the ground, and partly on account of customs peculiar to the spots. That which we are about to describe is the method usually adopted in the Newcastle coal field; the chief sources of information on the subject being contained in the evidence given before the committees of the Houses of Lords and Commons in 1829 and 1830, by Mr. Buddle and Mr. Taylor, eminent engineers or coal viewers, and of large experience in the north of England collieries.

No instances occur in this country of beds of coal lying so near the surface that they can be worked in open day like a stone quarry, nor are they often met with in the side of a hill, so that the mines can be pushed forward in a horizontal direction. When, therefore a coal-field is to be *won*, as it is technically called, that is, when the coals are to be taken out, the first step is to sink a perpendicular circular shaft, like a great well, in order to get at the coal, and by which the miners or pitmen descend, and the coal is brought to the surface. The sum required for winning a field of coal, that is, the coal under a certain portion of land marked out on the surface, is sometimes so considerable, and the risk of failure so great, that very few individuals venture upon it on their sole account. They are usually won by a company, called adventurers, who take a lease from the proprietor. On the river Tyne there are only five proprietors, out of the forty-one collieries, who work their own mines, and on the river Wear there are only three out of eighteen collieries; all the rest are in the hands of lessees or adventurers. The capital is raised by shares, often of small amount, and being transferable, are constantly in the market. Collieries vary exceedingly as to the amount of capital required to win them, the difference being so great as from £10,000 to £150,000. One of the difficulties in sinking a shaft is passing through quicksands; another is the immense quantities of water which are met with in certain parts of the stratification, generally within forty or fifty fathoms from the surface, which is always dammed back by a tub. Mr. Buddle mentions a shaft in which he had to apply forty fathoms, that is, 240 feet, of cast-iron tubbing.

Thus, the vapours found beneath the surface of the earth are very various in their effects upon the constitution: and they are not less in their appearance. There are many kinds that seemingly are no way prejudicial to health, but in which the workmen breathe freely; and yet in these, if a lighted candle be introduced, they immediately take fire, and the whole cavern at once becomes one furnace of flame. In mines, therefore, subject to damps of this kind, they are obliged to have recourse to a very pe-

---

Besides, one shaft is not sufficient, another being required for drawing up the water and for ventilating the mine.

The depth of the mines is very various; in one place near Jarrow, about five miles from the mouth of the Tyne on its southern bank, the high main coal of the Tyne is found within 42 feet of the ground, and the same coal lies under Jarrow lake more than 1200 feet from the surface. This great depth is not reached by one perpendicular shaft, but a shaft and steam-engine under ground, with descending inclined planes. A great improvement was made by this erection of steam-engines to be worked in the pits underground, and which first took place in 1804.

The pit having been sunk to a sufficiently thick seam of coal, the process of excavating it begins, by cutting out the coal laterally in what are called galleries. In the Newcastle mines large masses of the coal, named pillars, are left to support the roof, at short intervals, but in Staffordshire the whole of the coal is taken away, and the roof of the mine is suffered to fall down, care being taken to support it so far as not to endanger the safety of the workmen. One set of workmen is employed in digging out the coal, and another in removing it to the bottom of the shaft, from whence it is drawn up by machinery to the surface. The work of the miners is very laborious, especially where the seams are so thin as to prevent their being in an erect posture.

In many collieries, after the whole of the coal has been got out in the ordinary way of working, they gradually cut away a part of the pillars of coal which had been left at intervals, for the support of the roof, substituting props of timber; and sometimes the whole of the pillar may be taken away without the roof falling in in such a manner as to impede the workman in other parts of the mine. When the whole of the coal has been excavated and the roof does not fall down, vast empty spaces or wastes are left, which very generally after a while, become filled with water, to the great danger of the adjoining collieries.

The chief accidents to which collieries are exposed, besides that of the roof and floor coming together, by the pressure over the places where the coal has been worked out, are inundations of water, and explosions of gas. The quantity of water which flows into the mines is sometimes quite enormous, and the expense of drawing it off by pumps worked by steam-engines is one of the heaviest charges of a colliery. Mr. Buddle states that in one with which he is connected, they draw eighteen times the weight of water which they do of coal. It very often happens that a mine is drowned by an accidental opening into an old working filled with water.

But of all the accidents to which coal-mines are exposed the explosions of inflammable gas or fire-damp are the most frequent, and by far the most calamitous in their consequences. All coal, even the charcoal-like variety called anthracite, appears to contain, in its natural state while underground, a considerable quantity of free uncombined gas, which it parts with when exposed to the air, or when it is relieved from great superincumbent pressure. The gas is evolved from the coal in great quantity at the ordinary temperature of the mines; and instances have been known of explosions on board of ships laden with fresh-worked coals. Coals lying deep give out more gas than those near the surface, because there are openings at the surface by which it escapes; but in the deep mines it cannot have such an outlet, and therefore it accumulates in all the fissures of the stone above the coal, and this sort of natural distillation is constantly going on. The fissures of the roof are in some places very great, and there are sometimes miles of communication from one fissure to another: they may be considered as natural gasometers, and having no outlet, and the process of distillation constantly going on, the gas becomes accumulated in them in a very highly condensed state, the degree of condensation depending on the thickness of the surrounding rock and the quantity poured in. In the course of pursuing the workings, the miners sometimes cut across one of those fissures, or approach so near to it, that the intervening rock becomes too weak to resist the elastic force of the compressed gas; it gives way, and then, in either case, the gas rushes out with immense force. These *blowers*, as they are called, emit sometimes as much as 700 hogsheads of gas in a minute, and continue in a state of activity for many months together. Sir James Lowther found a uniform current of gas in one of his mines for two years and nine months.

This gas, in the state in which it issues from the coal, burns with a bright flame, like ordinary artificial coal gas; but when united with a certain proportion of the air of the atmosphere, the mixture becomes explosive, that is, the whole volume of air, upon the approach of a flame, suddenly catches fire, and goes off like gunpowder, with a tremendous explosion. If there be more than one volume or bulk of the inflammable gas to fourteen of atmospheric air, the mixture is explosive, and must not be approached with a naked flame. Great pains are taken to ventilate the mines so as to free them from this foul air, by large fires kept constantly burning at the mouth of the ventilating shaft, aided very often by air-pumps worked by steam-engines, to quicken the draft; and which are sometimes so powerful as to draw out of the mine 1000 hogsheads of air in a minute. One mine is described by Mr. Buddle as generating so much gas as to require a supply of 18,000 cubic feet of atmospheric air in a minute to keep it in a safe working state. Men can continue to work and breathe in an explosive mixture of the gas without feeling any material inconvenience; and formerly such places were approached by making use of what were called Steel Mills, to give light. This machine consists of a small wheel of steel, of six or seven inches diameter, moved by a little toothed wheel with great velocity, and by holding a piece of flint to the steel, a stream of sparks is given out. Although in the day the light appears very feeble, in the darkness of the mines it is strong enough to enable one to write by it; but the use of the steel mill is not free from danger of explosion in certain mixtures of the gas. That contrivance has, however, been now completely set aside by the important and beautiful discovery of Sir Humphrey Davy, the SAFETY-LAMP.

That eminent philosopher instituted a long series of experiments on the nature of the fire-damp, and on the proportions with which it must be mixed with atmospheric air in order to become explosive. He found that, in respect of combustibility, the fire-damp differs most materially from the other common inflammable gases, inasmuch as it requires a far higher temperature before it can be set on fire; an iron rod, at the highest degree of red heat, and at the common degree of white heat, did not inflame explosive mixtures of the fire-damp, and an explosion only took place when a flame culiar contrivance to supply sufficient light for their operations. This is by a great wheel, the circumference of which is beset with flints, which striking against steels placed for that purpose at the extremity, a stream of fire is produced, which affords light enough, and yet which does not set fire to the mineral vapour.

Of this kind are the vapours of the mines about Bristol: on the contrary, in other mines, a single spark struck out from the collision of flint and steel, would set the whole shaft in a flame. In such, therefore, every precaution is used to avoid a collision; the workmen making use of wooden instruments in digging; and being cautious, before they enter the mine, to take out even the nails from their shoes. Whence this strange difference should arise, that the vapours of some mines catch fire with a spark, and others only with a flame, is a question that we must be content to leave in obscurity, till we know more of the nature both of mineral vapour and of fire. This we only may observe, that gunpowder will readily fire with a spark, but not with the flame of a candle; on the other hand, spirits of wine will flame with a candle, but not with a spark: but even here the cause of this difference as yet remains a secret.

As from this account of mines, it appears that the internal parts of the globe are filled with vapours of various kinds, it is not surprising that they should, at different times, reach the surface, and there put on various appearances. In fact, much of the salubrity, and much of the unwholesomeness, of climates and soils, is to be ascribed to these vapours, which make their way from the bowels of the earth upwards, and refresh or taint the air with their exhalations. Salt mines, being naturally cold,[1] send forth a degree of coldness to the external air, to comfort and refresh it: on the contrary, metallic mines are known not only to warm it with their exhalations, but often to destroy all kinds of vegetation by their volatile corrosive fumes. In some mines, dense vapours are plainly perceived issuing from their mouths, and sensibly warm to the touch. In some places neither snow nor ice will continue on the ground that covers a mine; and over others the fields are found destitute of verdure.[2] The inhabitants, also, are rendered dreadfully sensible of these subterraneous exhalations, being affected with such a variety of evils proceeding entirely from this cause, that books have been professedly written upon this class of disorders.

Nor are these vapours, which thus escape to the surface of the earth, entirely unconfined; for they are frequently, in a manner, circumscribed to a spot. The Grotto del Cane, near Naples, is an instance of this;

---

was applied. He further made the important discovery, that flame will not pass through a tube with a very small bore; and guided by this principle, he was ultimately led, through a train of ingenious experiments, to the construction of an instrument which has saved, and will continue to save, the lives of hundreds, and which has rendered a large extent of property productive that the proprietors were unable to turn to any profitable account. The construction of the lamp depends upon two principles discovered by Sir H. Davy, namely, that fire-damp will only explode at a very high temperature, and that flame will not pass through very fine tubes. Now the power of tubes in preventing the transmission of flame is not necessarily connected with any particular length, a very short one will have the effect, provided its diameter be proportionally reduced; and so Sir H. Davy, considering that fine wire-gauze is an assemblage of very short tubes with a very small bore, found that a gauze containing 625 apertures in a square inch, which is coarse enough to transmit a great deal of light, will not allow flame to pass through it. Any one may convince himself of this by holding a piece of fine wire-gauze over the flame of a candle, or, what is better, over the flame of a spirit-lamp, or of a gas-lamp, for in these cases the gauze becomes red-hot. Flame is gaseous matter heated so intensely as to be luminous, and, as we have said above, the flame of fire-damp is only kindled at a temperature much higher than that of iron at a white heat. Now when flame comes in contact with the sides of very minute apertures, as when wire-gauze is laid upon a burning jet of coal-gas, it is deprived of so much heat that its temperature instantly falls below the degree at which inflammation can be maintained, and consequently, although the gas itself is passing freely through the interstices, that portion of it which is above the gauze, although very hot, is not sufficiently so to be luminous, —that is, to be in a state of flame. Nor does this take place only when the wire is cold—the effect is equally certain at any degree of heat which the flame can communicate to it; for since the gauze has a large extent of surface, and, from its metallic nature, is a good conductor, it loses heat with great rapidity. Its temperature, therefore, though it may be heated to whiteness, is always so far below that of flame, as to exert a cooling influence over the burning gas, and reduce its heat below the point at which it is luminous. When the lamp is carried into a part of the mine which is highly charged with fire-damp, the flame of the wick begins to enlarge, and the air, if it contain so much of the inflammable gas as to be highly explosive, takes fire as soon as it has passed through the gauze, and then burning within the lamp extinguishes the flame of the wick, by cutting off all communication with the pure air of the atmosphere. Whenever this appearance is observed, the miner must instantly withdraw; for although the flaming gas within the lamp cannot pass through the gauze so as to set fire to the explosive mixture outside, it makes the wire gauze so hot that it would very speedily be wasted, and a hole, large enough to let the flame come out, would be burned.

The "fire-damp" of the coal mines is the light carburetted hydrogen of chemists, CH_2, and forms the most considerable constituent of common coal gas. When it explodes, it is converted into carbonic acid gas, CO_2, the "choke-damp" of the mines, which extinguishes flame, and does not support animal life. It is this latter gas which flows into the Grotto del Cane, referred to in the text.

[1] Phil. Trans. vol. ii. p 523. [2] Boyle, vol. iii. p. 238.

the noxious effects of which have made that cavern so very famous. This grotto, which has so much employed the attention of travellers, lies within four miles of Naples, and is situated near a large lake of clear wholesome water.[1] Nothing can exceed the beauty of the landscape which this lake affords; being surrounded with hills covered with forests of the most beautiful verdure, and the whole bearing a kind of amphitheatrical appearance. However, this region, beautiful as it appears, is almost entirely uninhabited; the few peasants that necessity compels to reside there, looking quite consumptive and ghastly, from the poisonous exhalations that rise from the earth. The famous grotto lies on the side of a hill, near which place a peasant resides, who keeps a number of dogs for the purpose of showing the experiment to the curious. These poor animals always seem perfectly sensible of the approach of a stranger, and endeavour to get out of the way. However, their attempts being perceived, they are taken and brought to the grotto; the noxious effects of which they have so frequently experienced. Upon entering this place, which is a little cave, or hole rather, dug into the hill, about eight feet high, and twelve feet long, the observer can see no visible mark of its pestilential vapour; only to about a foot from the bottom, the wall seems to be tinged with a colour resembling that which is given by stagnant waters. When the dog, this poor, philosophical martyr, as some have called him, is held above this mark, he does not seem to feel the smallest inconvenience; but when his head is thrust down lower he struggles to get free for a little; but in the space of four or five minutes he seems to lose all sensation, and is taken out seemingly without life. Being plunged in the neighbouring lake, he quickly recovers, and is permitted to run home, seemingly without the smallest injury.

This vapour, which thus for a time suffocates, is of the humid kind, as it extinguishes a torch, and sullies a looking-glass; but there are other vapours perfectly inflammable, and that only require the approach of a candle to set them blazing. Of this kind was the burning well at Brosely, which is now stopped up; the vapour of which, when a candle was brought within about a foot of the surface of the water, caught flame like spirits of wine, and continued blazing several hours after. Of this kind, also, are the perpetual fires in the kingdom of Persia. In that province, where the worshippers of fire hold their chief mysteries, the whole surface of the earth, for some extent, seems impregnated with inflammable vapours. A reed stuck into the ground continues to burn like a flambeau; a hole made beneath the surface of the earth instantly becomes a furnace, answering all the purposes of a culinary fire. There they make lime by merely burying the stones in the earth; and watch with veneration the appearances of a flame that has not been extinguished for times immemorial. How different are men in various climates! This deluded people worship these vapours as a deity, which in other parts of the world are considered as one of the greatest evils.

CHAP. IX.

OF VOLCANOES AND EARTHQUAKES.

Mines and caverns, as we have said, reach but a very little way under the surface of the earth, and we have hitherto had no opportunities of exploring further. Without all doubt the wonders that are still unknown surpass those that have been represented, as there are depths of thousands of miles which are hidden from our inquiry. The only tidings we have from those unfathomable regions are by means of volcanoes, those burning mountains that seem to discharge their materials from the lowest abysses of the earth.[2] A volcano may be considered as a cannon of immense size, the mouth of which is often near two miles in circumference. From this dreadful aperture are discharged torrents of flame and sulphur, and rivers of melted metal. Whole clouds of smoke and ashes, with rocks of enormous size, are discharged to many miles' distance; so that the force of the most powerful artillery, is but as a breeze agitating a feather in comparison. In the deluge of fire and melted matter which runs down the sides of the mountain, whole cities are sometimes swallowed up and consumed. Those rivers of liquid fire are sometimes two hundred feet deep; and when they harden, frequently form considerable hills. Nor is the danger of these confined to the eruption only: but the force of the internal fire struggling for vent, frequently produces earthquakes through the whole region where the volcano is situated. So dreadful have been these appearances, that men's terrors have added new horrors to the scene, and they have regarded as prodigies, what we know to be the result of natural causes. Some philosophers have considered them as vents communicating with the fires of the centre; and the ignorant as the mouths of hell itself. Astonishment produces fear, and fear superstition: the inhabitants of Iceland believe the bellowings of Hecla are nothing else but the cries of the damned, and that its eruptions are contrived to increase their tortures.

---

[1] Kircher, Mund. Subt. vol. i. p. 191.

[2] Buffon, vol. i. p. 291.

But if we regard this astonishing scene of terror with a more tranquil and inquisitive eye, we shall find that these conflagrations are produced by very obvious and natural causes. We have already been apprised of the various mineral substances in the bosom of the earth, and their aptness to burst out into flames. Marcasites and pyrites, in particular, by being humified with water or air, contract this heat, and often endeavour to expand with irresistible explosion. These, therefore, being lodged in the depths of the earth, or in the bosom of mountains, and being either washed by the accidental influx of waters below, or fanned by air insinuating itself through perpendicular fissures from above, take fire at first by only heaving in earthquakes, but at length by bursting through every obstacle, and making their dreadful discharge in a volcano.[1]

These volcanoes are found in all parts of the earth. In Europe there are three that are very remarkable; Ætna in Sicily, Vesuvius in Italy, and Hecla in Iceland. Ætna has been a volcano for ages immemorial. Its eruptions are very violent, and its discharge has been known to cover, for a certain space around, eight-six feet deep. In the year 1537, an eruption of this mountain produced an earthquake through the whole island for twelve days, overturned many houses, and at last formed a new aperture, which overwhelmed all within five leagues round. The cinders thrown up were driven even into Italy, and its burnings were seen at Malta, at the distance of sixty leagues. "There is nothing more awful," says Kircher, "than the eruptions of this mountain, or nothing more dangerous than attempting to examine its appearances, even long after the eruption has ceased. As we attempt to clamber up its steepy sides, every step we take upwards, the feet sink back half-way. Upon arriving near the summit, ashes and snow, with an ill-assorted conjunction, present nothing but objects of desolation. Nor is this the worst, for, as all places are covered over, many caverns are entirely hidden from the sight, into which, if the inquirer happens to fall, he sinks to the bottom, and meets inevitable destruction. Upon coming to the edge of the great crater, nothing can sufficiently represent the tremendous magnificence of the

---

[1] Volcanic action is defined by Humboldt to be the influence exerted by the heated interior of the earth upon its external surface, during the different stages of its cooling and condensation; by which concussions of the land, or earthquakes, and the expansion or elevation, and the contraction or subsidence, of large portions of the solid crust of the earth have been produced. Various hypotheses have been proposed to account for the origin of the heat in volcanoes. Instead of an original central heat, as supposed by Humboldt and other authors, Sir Charles Lyell refers the heat of the interior to chemical changes constantly going on in the earth's crust; for the general effect of chemical combination is the evolution of heat and electricity, which in their turn become sources of new chemical changes. But whatever may be the cause of the internal heat, there can be no doubt that the phenomena of volcanic action are due to the power of elastic vapours produced by heat in the subterranean regions. The number of existing volcanoes is estimated at about 200, of which 116 are situated in America and its islands. The ordinary form of volcanoes in all parts of the globe is that of an isolated conical mountain, such as Vesuvius, Ætna, the Peak of Teneriffe, Tunguragua, and Cotopaxi. In addition to these isolated cones, there are also permanent craters opening into the interior of the earth, and which are situated on long chains of mountains with serrated crests, and not always on the middle of the ridge, but sometimes at its extremity. The materials erupted from volcanoes consist of ashes, scoriæ, and floods of lava, which are disposed on the cones more or less concentrically, giving rise to "craters of eruption." In another description of volcanic mountains, the central crater is formed of pre-existing horizontal beds of rocks that have been forced into highly inclined positions by the sudden upheaval of incandescent mineral matter, or by the expansion of elastic vapour. A dome or cone is thus produced, with an opening in the centre, around which the upheaved strata are concentrically arranged, being covered to some extent by the materials ejected by subsequent eruptions. These are named by Von Buch, "craters of elevation." Among the products of modern volcanoes are found iron, copper, lead, and other metals. The rocks of Vesuvius have yielded 400 species of simple minerals. Aqueous vapours are also emitted in abundance from volcanoes. Torrents of mud sometimes accompany eruptions, a phenomenon which has been ascribed to the products of the volcano, but which Humboldt accounts for by supposing that the ashes, on being discharged into the atmosphere, come into contact with rain clouds, from which they descend in the form of mud. In the Andes, where the summits of the volcanic mountains rise into the region of perpetual snow, the sudden evolution of heat is frequently the cause of disastrous inundations from the melting of the snow. Torrents of water, bearing along heated masses of scoriæ and blocks of ice, rush down the sides of the mountains, and overwhelm the plains below.

Southern Italy is the centre of volcanic action in Europe; and Ætna, Vesuvius, and the Lipari Islands are the channels of communication with the interior of the earth. Ætna, in the north-east of Sicily, rises near the sea in solitary grandeur, to the height of nearly 11,000 feet. The base of the cone is almost circular, and eighty-seven miles in circumference, and its lavas are spread over a circuit of twice that extent. The mountain has its fertile, woody, and desert regions; the first forming the charming country skirting the base; the second, the woody zone encircling the intermediate part; and the third or upper region, surrounding the cone of eruption, and presenting a desolate plain covered with black lava and scoriæ. From this plain the cone of eruption springs to a height of 1100 feet, and is continually evolving sulphureous vapour. Numerous minor cones are distributed over the wooded flanks of the mountain, presenting every variety of height and size, and arranged in picturesque groups. The principal cone has repeatedly fallen in, and been reproduced. The volcano has been in activity from the earliest periods of history. In 1669, when a great eruption took place, two gulfs opened near the town of Catania, from whence sand and scoriæ were thrown up in such quantity, that in three or four months a double cone was formed, called Monti Rossi, about 450 feet high. The Val del Bove commences near the summit of Ætna, and lays open to view a great part of the structure of the mountain, forming a vast amphitheatre four or five miles in diameter, surrounded by nearly vertical precipices, varying from 1000 to above 3000 feet in height, and exhibiting several thousand upright dikes of basalt and trachyte, which are seen in all directions traversing the volcanic beds. An eruption in 1755 precipitated two fiery torrents of lava upon the snow which then covered the mountain, and flowing to a distance of three miles, produced a frightful inundation, which devastated the sides of Ætna for eight miles in length.

A glacier, or huge mass of ice, was discovered in 1828 to have been covered by a current of red-hot lava ejected by some former eruption, and preserved from melting for many years, or, as Lyell conjectures, perhaps for centuries. Amongst the more notable eruptions of Ætna of late years, were those of 1811, 1819, and 1832. Within the historical period there are no records tending to show that the height of Ætna has been materially changed within the last 2000 years. The crater is about ¾ mile in circumference.

The Crater of Ætna.

The volcanic region of Naples consists of a linear group of cones ranging north-east and south-west, and terminating at either extremity in the two principal mountains, Ischia and Vesuvius. The latter mountain is about 4000 feet high, with a broken and irregular crest. The great crater of Vesuvius had been gradually filled by lava ejected from the interior, and by ashes falling from the minor vents, during the period from the close of the eighteenth century till the year 1822, when the accumulated mass was dislodged by a succession of tremendous explosions, continuing for more than twenty days, leaving an immense chasm about three miles in circumference. Upwards of 800 feet of the cone was carried away by these convulsions, reducing the altitude of the mountain from 4200 to 3400 feet. Lava currents from Vesuvius have been observed to flow a mile and a half in fourteen minutes, whilst others have reached the sea in three hours from the summit of the mountain, a distance of 3200 yards. In an eruption witnessed by Sir W. Hamilton, jets of liquid lava, mingled with stones and scoriæ, were thrown to a height of 10,000 feet. Another observer of an eruption by night, remarks, that if any person could fancy the effect of several thousand sky-rockets darting up at once to a height of 3000 or 4000 feet, and then falling back in the shape of red-hot balls, shells, and masses of fiery rock, he might have an idea of a single explosion of this burning mountain. Vesuvius is frequently in eruption, with rarely an interval of rest exceeding ten years.

Amongst existing volcanoes, that of Kilauea, in Hawaii, one of the Sandwich Islands, is one of the most stupendous in extent, and energetic in action. The island, which is about 100 miles long, and covers an area of 4000 square miles, is one entire mass of volcanic matter, perforated by innumerable craters. The two principal volcanic mountains rise to a height little short of 14,000 ft. The volcano of Kilauea, 3970 feet high, presents, instead of a cone, a vast chasm, of irregular form, with precipitous sides, three and a half miles long, by two and a half in breadth, and 1000 feet deep. During the day, the crater exhibits a heap of smouldering ashes, but the darkness of night reveals two lakes of a fiery liquid, in a state of violent ebullition. In South America volcanic action is exerted over an extensive territory, and the vents of the subterranean fires reach to the loftiest summits of the Andes. The elevated plain of Malpais, in Mexico, although obviously of igneous origin, had remained undisturbed from the period of the discovery of America till the year 1759, when a succession of earthquakes terminated in a volcanic convulsion. Six principal cones were formed, the least of them being 300 feet in height, and Jorullo, the central volcano, was elevated 1600 feet above the level of the plain. It sent forth streams of lava, and its eruptions lasted till early in the year 1760. The central cone of Jorullo is still burning. Volcanic action takes place alike on land and beneath the waters of the ocean. A striking instance of a submarine volcano occurred in 1831, when a new island emerged from the Mediterranean, on the S.W. coast of Sicily, and received the name of Graham Island. It attained the magnitude of three miles in circumference, and above 200 feet in height, when it gradually began to yield to the abrading action of the waves, and finally disappeared, leaving only a dangerous submerged reef, after having been visible from July till September. In Iceland, the celebrated Geysers illustrate the power of aqueous vapour as a volcanic agent. These boiling springs rise through a thick bed of lava, which may perhaps have flowed from Mount Hecla, the summit of that volcano being seen from the spot at the distance of thirty miles. The eruptions of water from the boiling fountains are intermittent, occurring after irregular intervals. The diameter of the basin of the Great Geyser is 56 feet in one direction, and 46 feet in another. In the centre is a pipe or funnel, 78 feet in perpendicular depth, and from 8 to 10 feet in diameter, but widening as it rises into the basin. The water is ejected with great force, accompanied by loud subterranean noises, and ascends to a height of 100 or 200 feet. After playing for a time like an artificial fountain, and giving off clouds of vapour, the funnel is emptied, and a column of steam rushing up with a noise like thunder, terminates the eruption.

scene. A gulf two miles over, and so deep that no bottom can be seen; on the sides pyramidical rocks starting out between apertures that emit smoke and flame; all this, accompanied with a sound that never ceases, louder than thunder, strikes the bold with horror, and the religious with veneration for HIM that has power to control its burnings."

In the descriptions of Vesuvius or Hecla, we shall find scarcely anything but a repetition of the same terrible objects, but rather lessened, as these mountains are not so large as the former. The crater of Vesuvius is but a mile across, according to the same author; whereas that of Ætna is two. On this particular, however, we must place no dependence, as these caverns every day alter; being lessened by the mountain's sinking in at one eruption, and enlarged by the fury of another. It is not one of the least remarkable particulars respecting Vesuvius, that Pliny the Naturalist was suffocated in one of its eruptions; for his curiosity impelling him too near, he found himself involved in smoke and cinders when it was too late to retire; and his companions hardly escaped to give an account of the misfortune. It was in that dreadful eruption that the city of Herculaneum was overwhelmed; the ruins of which have lately been discovered at sixty feet distance below the surface, and, what is still more remarkable, forty feet below the bed of the sea. One of the most remarkable eruptions of this mountain was in the year 1707, which is finely described by Valetta, a part of whose description I shall beg leave to translate.

"Towards the latter end of summer, in the year 1707, the mount Vesuvius, that had for a long time been silent, now began to give some signs of commotion. Little more than internal murmurs at first were heard, that seemed to contend within the lowest depths of the mountain; no flame, nor even any smoke, was as yet seen. Soon after some smoke appeared by day, and a flame by night, which seemed to brighten all the Campania. At intervals, also, it shot off substances with a sound very like that of artillery, but which, even at so great a distance as we were at, infinitely exceeded them in greatness. Soon after, it began to throw up ashes, which, becoming the sport of the winds, fell at great distances, and some many miles. To this succeeded showers of stones, which killed many of the inhabitants of the valley, and made a dreadful ravage among the cattle. Soon after, a torrent of burning matter began to roll down the sides of the mountain, at first with a slow and gentle motion, but soon with increased celerity. The matter thus poured out, when cold seemed upon inspection to be of vitrified earth, the whole united into a mass of more than stony hardness. But what was particularly observable was, that upon the whole surface of these melted materials, a light spongy stone seemed to float, while the lower body was of the hardest substance of which our roads are usually made. Hitherto there were no appearances but what had been often remarked before; but on the third or fourth day, seeming flashes of lightning were shot forth from the mouth of the mountain, with a noise far exceeding the loudest thunder. These flashes, in colour and brightness, resembled what we usually see in tempests, but they assumed a more twisted and serpentine form. After this followed such clouds of smoke and ashes, that the whole city of Naples, in the midst of the day, was involved in nocturnal darkness, and the nearest friends were unable to distinguish each other in this frightful gloom. If any person attempted to stir out without torch-light, he was obliged to return, and every part of the city was filled with supplications and terror. At length, after a continuance of some hours, about one o'clock at midnight, the wind blowing from the north, the stars began to be seen; the heavens, though it was night, began to grow brighter; and the eruptions, after a continuance of fifteen days, to lessen. The torrent of melted matter was seen to extend from the mountain down to the shore; the people began to return to their former dwellings, and the whole face of nature to resume its former appearance."

The famous Bishop Berkeley gives an account of one of these eruptions in a manner something different from the former.[1] "In the year 1717, and the middle of April, with much difficulty I reached the top of Mount Vesuvius, in which I saw a vast aperture full of smoke, which hindered me from seeing its depth and figure. I heard within that horrid gulf certain extraordinary sounds, which seemed to proceed from the bowels of the mountain, a sort of murmuring, sighing, dashing sound; and, between whiles, a noise like that of thunder or cannon, with a clattering like that of tiles falling from the tops of houses into the streets. Sometimes, as the wind changed, the smoke grew thinner, discovering a very ruddy flame, and the circumference of the crater streaked with a red and several shades of yellow. After an hour's stay, the smoke, being moved by the wind, gave us short and partial prospects of the great hollow, in the flat bottom of which I could discern two furnaces almost contiguous; that on the left seeming about three yards over, glowing with ruddy flame, and throwing up red-hot stones with a hideous noise, which, as they fell back, caused the clattering already taken notice of.—May 8, in the morning, I ascended the top of Vesuvius a second time, and found a different face of things. The smoke ascending upright, gave a full prospect of the crater, which, as I could judge, was about a mile in circumference, and a hundred yards deep. A conical mount had been formed, since my last visit, in the middle of the bottom, which I could see was made by the stones, thrown up and fallen back again into the crater. In this new hill remained the two furnaces already mentioned. The one was seen to throw up every three or four minutes, with a dreadful sound, a vast number of red-hot stones, at least three hundred feet higher than my head, as I stood upon the brink; but as there was no wind, they fell perpendicularly back from whence they had been discharged. The other was filled with red-hot liquid matter, like that in the furnace of a glass-house, raging and working like the waves of the sea, with a short abrupt noise. This matter would sometimes boil over, and run down the sides of the conical hill, appearing at first red-hot, but changing colour as it hardened and cooled. Had the wind driven in our faces, we had been in no small danger of stifling by the sulphureous smoke, or being killed by the masses of melted minerals that were shot from the bottom. But as the wind was favourable, I had an opportunity of surveying this amazing scene for about an hour and a half together. On the 5th of June, after a horrid noise, the mountain was seen at Naples to work over; and, about three days after, its thunders were renewed so, that not only the windows in the city, but all the houses shook. From that time it continued to overflow, and sometimes at night were seen columns of fire shooting upward from its summit. On the tenth, when all was thought to be over, the mountain again renewed its terrors, roaring and raging most violently. One cannot form a juster idea of the noise, in the most violent fits of it, than by imagining a mixed sound made up of the raging of a tempest, the murmur of a troubled sea, and the roaring of thunder and artillery, confused all together. Though we heard this at a distance of twelve miles, yet it was very terrible. I therefore resolved to approach nearer to the mountain; and accordingly, three or four of us got into a boat, and were set ashore at a little town situated at the foot of the mountain. From thence we rode about four or five miles, before we came to the torrent of fire that was descending from the side of the volcano; and here the roaring grew exceedingly loud and terrible as we approached. I observed a mixture of colours in the cloud, above the crater, green, yellow, red, and blue. There was likewise a ruddy dismal light in the air, over that tract where the burning river flowed. These circumstances, set off and augmented by the horror of the night, made a scene the most uncommon and astonishing I ever saw; which still increased as we approached the burning river. Imagine a vast torrent of liquid fire, rolling from the top down the side of the mountain, and with irresistible fury bearing down and consuming vines, olives, and houses; and divided into different channels, according to the inequalities of the mountain. The largest stream seemed half a mile broad at least, and five miles long. I walked so far before my companions up the mountain, along the side of the river of fire, that I was obliged to retire in great haste, the sulphureous stream having surprised me, and almost taken away my breath. During our return, which was about three o'clock in the morning, the roaring of the mountain was heard all the way, while we observed it throwing up huge spouts of fire and burning stones, which, falling, resembled the stars in a rocket. Sometimes I observed two or three distinct columns of flame, and sometimes one only, that was large enough to fill the whole crater. These burning columns and fiery stones seemed to be shot a thousand feet perpendicular above the summit of the volcano; and in this manner the mountain continued raging for six or eight days after. On the 18th of the same month the whole appearance ended, and the mountain remained perfectly quiet, without any visible smoke or flame."

---

[1] Phil. Trans. vol. ii. p. 209.

The matter which is found to roll down from the mouth of all volcanoes in general, resembles the dross that is thrown from a smith's forge. But it is different, perhaps, in various parts of the globe; for, as we have already said, there is not a quarter of the world that has not its volcanoes. In Asia, particularly in the islands of the Indian Ocean, there are many. One of the most famous is that of Albouras, near Mount Taurus, the summit of which is continually on fire, and covers the whole adjacent country with ashes. In the island of Ternate there is a volcano, which some travellers assert, burns most furiously in the times of the equinoxes, because of the winds which then contribute to increase the flames. In the Molucca Islands, there are many burning mountains; they are also seen in Japan, and the islands adjacent; and in Java and Sumatra, as well as in other of the Philippine

Islands. In Africa there is a cavern, near Fez, which continually sends forth either smoke or flames. In the Cape de Verde Islands, one of them, called *the Island de Fuego*, continually burns; and the Portuguese, who frequently attempted a settlement there, have as often been obliged to desist. The Peak of Teneriffe is, as everybody knows, a volcano, that seldom desists from eruptions. But of all parts of the earth, America is the place where those dreadful irregularities of nature are the most conspicuous. Vesuvius, and Ætna itself, are but mere fire-works in comparison to the burning mountains of the Andes; which, as they are the highest mountains of the world, so also are they the most formidable for their eruptions. The mountain of Arequipa, in Peru, is one of the most celebrated; Carassa and Malahallo are very considerable; but that of Cotopaxi, in the province of Quito, exceeds anything we have hitherto read or heard of. The mountain of Cotopaxi, as described by Ulloa,[1] is more than three miles perpendicular from the sea; and it became a volcano at the time of the Spaniards' first arrival in that country. A new eruption of it happened in the year 1743, having been some days preceded by a continual roaring in its bowels. The sound of one of these mountains is not, like that of the volcanoes in Europe, confined to a province, but is heard at a hundred and fifty miles' distance.[2] "An aperture was made in the summit of this immense mountain; and three more about equal heights near the middle of its declivity, which was at that time buried under prodigious masses of snow. The ignited substances ejected on that occasion, mixed with a prodigious quantity of ice and snow, melting amidst the flames, were carried down with such astonishing rapidity, that in an instant the valley from Callo to Latucunga was overflowed; and besides its ravages in bearing down the houses of the Indians, and other poor inhabitants, great numbers of people lost their lives. The river of Latucunga was the channel of this terrible flood; till being too small for receiving such a prodigious current, it overflowed the adjacent country, like a vast lake, near the town, and carried away all the buildings within its reach. The inhabitants retired into a spot of higher ground behind the town, of which those parts which stood within the limits of the current were totally destroyed. The dread of still greater devastations did not subside for three days; during which the volcano ejected cinders, while torrents of melted ice and snow poured down its sides. The eruption lasted several days, and was accompanied with terrible roarings of the wind, rushing through the volcano, still louder than the former rumblings in its bowels. At last all was quiet, neither fire nor smoke to be seen, nor noise to be heard; till in the ensuing year, the flames again appeared with recruited violence, forcing their passage through several other parts of the mountain, so that in clear nights the flames being reflected by the transparent ice, formed an awfully magnificent illumination."

Such is the appearance and effect of those fires which proceed from the more inward recesses of the earth: for that they generally come from deeper regions than man has hitherto explored, I cannot avoid thinking, contrary to the opinion of Mr. Buffon, who supposes them rooted but a very little way below the bed of the mountain. "We can never suppose," says this great naturalist, "that these substances are ejected from any great distance below, if we only consider the great force already required to fling them up to such vast heights above the mouth of the mountain; if we consider the substances thrown up, which we shall find upon inspection to be the same with those of the mountain below; if we take into our consideration that air is always necessary to keep up the flame; but, most of all, if we attend to one circumstance, which is, that if these substances were exploded from a vast depth below, the same force required to shoot them up so high, would act against the sides of the volcano, and tear the whole mountain in pieces." To all this specious reasoning, particular answers might be easily given; as, that the length of the funnel increases the force of the explosion; that the sides of the funnel are actually often burst with the great violence of the flame; that air may be supposed at depths at least as far as the perpendicular fissures descend. But the best answer is a well known fact; namely, that the quantity of matter discharged from Ætna alone, is supposed, upon a moderate computation, to exceed twenty times the original bulk of the mountain.[3] The greatest part of Sicily seems covered with its eruptions. The inhabitants of Catania have found, at the distance of several miles, streets and houses sixty feet deep, overwhelmed by the lava or matter it has discharged. But what is still more remarkable, the walls of these very houses have been built of materials evidently thrown up by the mountain. The inference from all this is very obvious; that the matter thus exploded cannot belong to the mountain itself, otherwise it would have been quickly consumed; it cannot be derived from moderate depths, since its amazing quantity evinces that all the places near the bottom must have long since been exhausted; nor can it have an extensive, and, if I may so call it, a superficial spread, for then the country round would be quickly undermined; it must, therefore, be supplied from the deeper regions of the earth; those undiscovered tracts where the Deity performs his wonders in solitude, satisfied, with self-approbation!

---

[1] Ulloa, vol. i. p. 442.

[2] Ibid.

[3] Kircher, Mund. Subt. vol. i. p. 202.

CHAP. X.

OF EARTHQUAKES.

Having given the theory of volcanoes, we have in some measure given also that of earthquakes. They both seem to proceed from the same cause, only with this difference, that the fury of the volcano is spent in the eruption; that of an earthquake spreads wider, and acts more fatally by being confined. The volcano only affrights a province; earthquakes have laid whole kingdoms in ruin.

Philosophers[1] have taken some pains to distinguish between the various kinds of earthquakes, such as the tremulous, the pulsative, the perpendicular, and the inclined; but these are rather the distinctions of art than of nature, mere accidental differences arising from the situation of the country or of the cause. If, for instance, the confined fire acts directly under a province or a town, it will heave the earth perpendicularly upward, and produce a *perpendicular* earthquake. If it acts at a distance, it will raise that tract obliquely, and thus the inhabitants will perceive an *inclined* one.

Nor does it seem to me that there is much greater reason for Mr. Buffon's distinction of earthquakes; one kind of which he supposes[2] to be produced by fire in the manner of volcanoes, and confined but to a very narrow circumference. The other kind he ascribes to the struggles of confined air, expanded by heat in the bowels of the earth, and endeavouring to get free. For how do these two causes differ? Fire is an agent of no power whatsoever without air. It is the air, which being at first compressed, and then dilated in a cannon, that drives the ball with such force. It is the air struggling for vent in a volcano, that throws up its contents to such vast heights. In short, it is the air confined in the bowels of the earth, and acquiring elasticity by heat, that produces all those appearances which are generally ascribed to the operation of fire. When, therefore, we are told that there are two causes of earthquakes, we only learn that a greater or smaller quantity of heat produces those terrible effects; for air is the only active operator in either.

Some philosophers, however, have been willing to give the air as great a share in producing these terrible efforts as they could; and, magnifying its powers, have called in but a very moderate degree of heat to put it in action. Although experience tells us that the earth is full of inflammable materials, and that fires are produced wherever we descend; although it tells us that those countries where there are volcanoes are most subject to earthquakes; yet they step out of their way, and so find a new solution. These only allow but just heat enough to produce the most dreadful phenomena, and, backing their assertions with long calculations, give theory an air of demonstration. Mr. Amontons[3] has been particularly sparing of the internal heat in this respect; and has shown, perhaps accurately enough, that a very moderate degree of heat may suffice to give the air amazing powers of expansion.

It is amusing enough, however, to trace the progress of a philosophical fancy let loose in imaginary speculations. They run thus: "A very moderate degree of heat may bring the air into a condition capable of producing earthquakes; for the air, at the depth of forty-three thousand five hundred and twenty-eight fathoms below the surface of the earth becomes almost as heavy as quicksilver. This, however, is but a very slight depth in comparison of the distance to the centre, and is scarcely a seventieth part of the way. The air, therefore, at the centre, must be infinitely heavier than mercury, or any body that we know of. This granted, we shall take something more, and say, that it is very probable there is nothing but air at the centre. Now let us suppose this air heated, by some means, even to the degree of boiling water; as we have proved that the density of the air is here very great, its elasticity must be in proportion; a heat therefore, which at the surface of the earth would have produced but a slight expansive force, must, at the centre, produce one very extraordinary, and, in short, be perfectly irresistible. Hence this force may, with great ease, produce earthquakes; and, if increased, it may convulse the globe; it may (by only adding figures enough to the calculation) destroy the solar system, and even the fixed stars themselves." These reveries generally produce nothing; for, as I have ever observed, increased calculations, while they seem to tire the memory, give the reasoning faculty perfect repose.

---

[1] Aristotle, Agricola, Buffon.

[2] Buffon, vol. ii. p. 328.

[3] Memoires de l'Academie des Sciences. An. 1703.

However, as earthquakes are the most formidable ministers of nature, it is not to be wondered that a multitude of writers have been curiously employed in their consideration. Woodward has ascribed the cause to a stoppage of the waters below the earth's surface by cause accident. These being thus accumulated, and yet acted upon by fires, which he supposes still deeper, both contribute to heave up the earth upon their bosom. This, he thinks, accounts for the lakes of water produced is an earthquake, as well as for the fires that sometimes burst from the earth's surface upon those dreadful occasions. There are others who have supposed that the earth may be itself the cause of its own convulsions. "When," say they, "the root or basis of some large tract is worn away by a fluid underneath, the earth sinking therein, its weight occasions a tremor of the adjacent parts, sometimes producing a noise, and sometimes an inundation of water." Not to tire the reader with a history of opinions instead of facts, some have ascribed them to electricity, and some to the same causes that produce thunder.[1]

It would be tedious, therefore, to give all the various opinions that have employed the speculative on this subject. The activity of the internal heat seems alone sufficient to account for every appearance that attends these tremendous irregularities of nature. To conceive this distinctly, let us suppose at some vast distance under the earth, large quantities of inflammable matter, pyrites, bitumens, and marcasites disposed, and only waiting for the aspersion of water, or the humidity of the air, to put their fires in motion: at last, this dreadful mixture arrives; waters find their way into those depths through the perpendicular fissures; or air insinuates itself through the same minute apertures: instantly new appearances ensue; those substances, which for

---

[1] The phenomena peculiar to earthquakes are in themselves sufficiently simple. They consist in tremblings and oscillations of the earth's surface, called shocks; extending over greater or smaller tracts of country, and frequently following a particular direction. The shocks appear at first chiefly as perpendicular heavings; then as horizontal undulations or oscillations; lastly, in some instances, there is a violent agitation: the motion is more or less rotatory. If to these we add the rending, slipping, rising, and sinking of the ground, the violent agitations of the sea, lakes, rivers, and springs; consisting, in springs, in their drying up or bursting forth with great violence; in lakes, rivers, and the ocean, in their falling and rising, and rushing backwards and forwards, owing to the sinking and rising of the land, we obtain an enumeration of the principal phenomena.

The slighter shocks of an earthquake, consisting of perpendicular heavings and horizontal undulations, commonly produce rents in houses, moving light objects in them, as articles of furniture. Persons unacquainted with the phenomenon, or who do not perceive it from the subterraneous noise resembling thunder which accompanies it, feel unsteady while in their beds, but particularly when sitting, and believe themselves seized with a sudden giddiness. The shocks proceed gradually to be more violent, and then they are very easily perceived even by the inexperienced. Then the most substantial buildings are shattered to pieces, and the inhabitants buried beneath their ruins; while buildings of a lighter construction are only rent, and very slender reed huts are least of all exposed to destruction. In some cases the fracturing, or as it were trituration, surpasses description. Hence, for the plainest reasons, it is most dangerous to remain in houses or inhabited places; but even the fields and mountains themselves afford no perfect security, inasmuch as the fields frequently in some places open into fissures, and are rent asunder; while mountains are not only rent, but slide down into the valleys, dam up rivers, form lakes, and cause inundations. Although the desolation produced by these convulsions exceeds all description, this is much more the case with the rotatory motions; a species of motion, however, the existence of which has been denied by some geologists. In proof of it, however, it may be mentioned, that during the earthquake of Catania, whose general direction was from S. E. to N. W., many statues were turned round, and a large mass of rock was turned 25° from south to east. But the rotatory motion was more strikingly exemplified in the earthquake at Valparaiso, on the 19th of November, 1822, by which many houses were turned round, and three palm trees were found twisted round one another like willows. These rotatory motions of masses of rock are particularly interesting when viewed in connection with phenomena connected with faults or shifts among strata in non-volcanic districts. In the earthquake at Calabria, two obelisks placed at the extremities of a magnificent façade in the convent of S. Bruno, in a small town called Stefano del Bosco, were observed to have undergone a movement of a singular kind. The shock which agitated the building is described as having been horizontal and verticose. The pedestal of each obelisk remained in its original place; but the separate stones above were turned partially round, and removed in some instances nine inches from their position without falling. See Plate III. fig. 1, for a representation of this.

It is the agitation of the sea that points out the great extent of the tracts of land convulsed by earthquakes. In this respect, the earthquake at Lisbon, in 1755, was the most remarkable and most violent that ever visited Europe. In consequence of it, by the concussion on the bottom, or momentary rising or upheaving of the sub-marine land, the sea overflowed the coasts of Sweden, England, and Spain, also the coasts of Antigua, Barbadoes, and Martinique in America. In Barbadoes, the tide, which rises only twenty-eight inches, rose twenty feet in the bay of Carlisle, and the water appeared as black as ink, owing probably to bituminous matter thrown up from the bed of the ocean. On the 1st of November, when the concussion was most violent, the water at Gaudaloupe retreated twice, and on its return rose in the channel of the island to the height of from ten to twelve feet. Similar appearances were witnessed at Martinique. A wave of the sea sixty feet high, overflowed a part of the city of Cadiz; and the lakes of Switzerland, such as Geneva, were observed to be in commotion six hours after the first shock. It is also remarkable that agitations were noticed in Lake Ontario, in October, 1755. During ages before lay dormant, now conceive new apparent qualities; they grow hot, produce new air, and only want room for expansion. However, the narrow apertures by which the air or water had at first admission are now closed up; yet as new air is continually generated, and as the heat every moment gives this air new elasticity, it at length bursts, and dilates all round; and, in its struggles to get free, throws all above it into similar convulsions. Thus an earthquake is produced more or less extensive, according to the depth or the greatness of the cause.

---

the earthquake at Lima, 1586, a wave of the sea rose eighty-four feet high in the harbour of Callao. During the earthquakes in Calabria in 1783, the sea not only overflowed the coast and drowned many people, but was in general so much agitated that the guns on ship-board sprang from the deck to a height of several inches.

Besides the common operations of earthquakes already mentioned, others occur that do not immediately succeed the concussions, and therefore happen less frequently. To these belong the sliding down of parts of mountains, as at Dobratch in 1345, and the falling together of two mountains in Jamaica in 1692, by which the bed of a river was dammed up. In the latter place, a part of a mountain slid down and covered many plantations; the city of Port Royal sunk to the depth of eight fathoms; and a plain of 1000 acres fell in, with all buildings upon it.

The magnitude of rents formed by earthquakes vary from a few feet to many fathoms in extent. They have either a direction which is nearly straight or more or less winding, or they run in all directions from a centre. During the terrible Calabrian earthquakes of 1783, rents were formed of great dimensions. At Jerocarne the country was lacerated in a most extraordinary manner, the fissures running in every direction like cracks on a broken pane of glass. (See Plate III. fig. 2, for a representation of this.) On the sloping side of a hill near Oppido, a great chasm opened in the form of an amphitheatre 500 feet long and 200 deep. (See Plate III. fig. 3, for a representation of this. See, too, figure 4, for a representation of another chasm in the hill of St. Angelo, near Soriano.) In the territory of San Fili there was formed a rent half a mile long, two feet and a half broad, and twenty-five feet deep; in the district of Plaisano, a rent of nearly a mile in length, one hundred and five feet broad, and thirty feet deep, opened; and in the same district two gulfs arose, one at Cerzulli, three quarters of a mile long, one hundred and fifty feet broad, and about one hundred feet deep; and another, nearly a quarter of a mile long, about thirty feet broad, and two hundred and twenty-five feet deep. Ulloa relates that in the earthquake of 1746, in Peru, a rent took place, which was two miles and a half long, and four or five feet wide. These rents sometimes close again; thus, in the year 1692, in the island of Jamaica, during an earthquake, the ground heaved like a boiling sea, and was traversed by numerous rents, two or three hundred of which were often seen at a time opening and closing rapidly again.

It is evident that if the land is fractured and then traversed with vast rents, by earthquakes, that portion of the land will in some places sink and in others rise, and this not once but several times in the same place. In the year 1772, during an eruption of one of the loftiest mountains in Java, the ground began to sink, and a great part of the volcano, and part of the neighbouring country, estimated to be fifteen miles long and six miles broad, was swallowed up. During the earthquake at Lisbon in 1755, a new quay entirely disappeared; thousands of the inhabitants had taken shelter on it, to be out of the reach of the tottering and falling buildings, when suddenly the quay sunk down with its thousands of human beings, and not one of their dead bodies ever floated to the surface. In the year 1692, during an earthquake in Jamaica, a tract of land about a thousand acres in extent, sank down in less than a minute, and the sea immediately took its place. On the north side of the island several large tracts with their whole population were swallowed up, and a lake appeared in their place covering above a thousand acres. Numerous examples of the uprising of the land by earthquakes might be given; we shall enumerate a few of them. On the 19th November, 1822, a most dreadful earthquake visited the coast of Chili; the shock was felt at the same time throughout a space of one thousand two hundred miles from north to south. When the country around Valparaiso was examined on the morning after the shock, it was found that the entire line of coast, for the distance of more than a hundred miles, was raised above its former level. The area over which this upraising took place was estimated at one hundred thousand square miles; the rise upon the coast was from two to four feet; at the distance of a mile inland, it was estimated from five to seven feet. On the 18th of March, in the year 1790, at St. Maria di Niscomi, some miles from Terranuovo, near the south coast of Sicily, a loud subterranean noise was heard under the town just mentioned, and the day after earthquakes were felt; then the ground gradually sunk down for a circumference of three Italian miles, during seven shocks, and in one place to a depth of thirty feet; as the substance was unequal, rents were formed, some of which were so wide that they could not be leaped over: this gradual sinking continued to the end of the month. About the middle of this period an opening took place in the subsiding land, about three feet in diameter; through which continued to flow, for three hours, a stream of mud, which covered a space sixty feet long and thirty feet broad; the mud was saltish, and composed of chalky marl and a viscid clay, with fragments of crystalline limestone; it smelt of sulphur and petroleum. On the 16th June, 1819, at Cutch in Bombay, a violent earthquake took place, during which, independent of other changes, the eastern and almost abandoned channel of the Indus, was much altered: this estuary was, before the earthquake, fordable at Luckput, being only a foot deep when the tide was at ebb, and at flood tide never more than six feet; but it was deepened at the fort of Luckput, after the earthquake, to more than eighteen feet at low water, showing that a considerable depression had taken place. The channel of the river Runn was so much sunk that, instead of being dry as before, during that period of the year, it was no longer fordable except at one place; and it is remarked by Captain Macmurdoch—and the observation is of high geological import, as connected with the formation of valleys, of river districts, &c.—"should the water continue throughout the year, we may perhaps see an inland navigation along the northern shore of Cutch; which, from stone anchors, &c., still to be seen, and the tradition of the country, I believe to have existed at some former period." Sindree, a small mud fort and village belonging to the Cutch government, situated where the Runn joins the Indus, was overflowed at the time of the shock. The people escaped with difficulty, and the tops of the houses and walls are now alone seen above water. In the year 1790, in the Caraccas, during an earthquake, a portion of granite soil sunk, and left a lake 800 yards in diameter, and from eighty to one hundred feet deep; it was a part of the forest of Aripao which sunk, and the trees remained green for several months under water.

But before we proceed with the causes, let us take a short view of the appearances which have attended the most remarkable earthquakes. By these we shall see how far the theorist corresponds with the historian. The greatest we find in antiquity is that mentioned by Pliny,[1] in which twelve cities in Asia Minor were swallowed up in one night: he tells us also of another near the lake Thrasymene, which was not perceived by the armies of the Carthaginians and Romans, that were then engaged near that lake, although it shook the greatest part of Italy. In another place[2] he gives the following account of an earthquake of an extraordinary kind. "When Lucius Marcus and Sextus Julius were consuls there appeared a very strange prodigy of the earth, (as I have read in the books of the Ætruscan discipline), which happened in the province of Mutina. Two mountains shocked against each other, approaching and retiring with the most dreadful noise. They at the same time, and in the midst of the day, appeared to cast forth fire and smoke, while a vast number of Roman knights and travellers from the Æmilian Way, stood and continued amazed spectators. Several towns were destroyed by this shock; and all the animals that were near them were killed." In the times of Trajan, the city of Antioch, and a great part of the adjacent country, was buried by an earthquake. About three hundred years after, in the times of Justinian, it was once more destroyed, together with forty thousand inhabitants; and, after an interval of sixty years, the same ill-fated city was a third time overturned, with the loss of not less than sixty thousand souls. In the year 1182, most of the cities of Syria, and the kingdom of Jerusalem, were destroyed by the same accident. In the year 1594, the Italian historians describe an earthquake at Puteoli, which caused the sea to retire two hundred yards from its former bed.

But one of those most particularly described in history, is that of the year 1693; the damages of which were chiefly felt in Sicily, but its motion perceived in Germany, France, and England. It extended to a circumference of two thousand six hundred leagues; chiefly affecting the sea-coast and great rivers; more perceivable also upon the mountains than in the valleys. Its motions were so rapid, that those who lay at their length were tossed from side to side, as upon a rolling billow. The walls were dashed from their foundations; and no less than fifty-four cities, with an incredible number of villages, were either destroyed or greatly damaged. The city of Catanea, in particular, was utterly overthrown. A traveller, who was on his way thither, at the distance of some miles, perceived a black cloud, like night, hanging over the place. The sea, all of a sudden, began to roar; Mount Ætna to send forth great spires of flame; and soon after a shock ensued, with a noise as if all the artillery in the world had been at once discharged. Our traveller, being obliged to alight, instantly felt himself raised a foot from the ground; and turning his eyes to the city, he, with amazement, saw nothing but a thick cloud of dust in the air. The birds flew about astonished: the sun was darkened; the beasts ran howling from the hills; and although the shock did not continue above three minutes, yet near nineteen thousand of the inhabitants of Sicily perished in the ruins. Catanea, to which city the describer was travelling, seemed the principal scene of ruin; its place only was to be found; and not a footstep of its former magnificence was to be seen remaining.[3]

---

[1] Plin. lib. ii. cap. 86.

[2] Ibid. lib. iii. cap. 85.

[3] The memorable earthquake of Lisbon took place in 1755. The city then contained about 150,000 inhabitants, 30,000 of whom are calculated to have perished. On the morning of the 1st November, without any previous warning, except a hollow noise like thunder, the ground suddenly began to shake with quick and short vibrations. The whole foundations of the city were disturbed, and many of the principal houses tumbled in an instant to the ground. The bed of the Tagus was in many places raised to a level with its surface. Ships were driven from their anchors, and jostled together with great violence. The large quay to which the people had flocked in crowds for safety or escape, was suddenly submerged, and the whole buried in one gulf. The bar was seen dry from shore to shore. Then suddenly the sea, like a mountain, came rolling in, and about Belem Castle the water rose fifty feet almost in an instant, and had it not been for the great bay opposite the city, which received and spread this vast inundation, the lower part must have been entirely under water. At Oporto, the same calamities occurred exactly at the same hour.

At Cadiz the shock was also violent, and through all parts of Europe, the neighbouring continent of Africa, and even America and the West India Islands, the effects of this convulsion were distinctly perceptible.

The earthquake that so much affected Calabria in Italy, and destroyed the city of Messina, raged at different periods from 5th February till the 28th March, 1783. Its principal seat was the small town of Oppido, in the neighbourhood of Atramonti, a snow-covered peak of the Apennines. The country for twenty-five miles round this point suffered most severely, but the ravages extended more or less for seventy-two miles. About two hundred towns and villages were destroyed; more than one hundred hills slid down, fell together, dammed up the rivers, and formed lakes. The number of human beings that perished was estimated at one hundred thousand, and it was difficult to find even distant relations to succeed to the property of some families.

In the great Neapolitan earthquake on the 16th of December, 1857, the number of persons killed, according to the official journal of the Kingdom of the Two Sicilies, was 9350, and the wounded amounted to 1359;

The earthquake which happened in Jamaica, in 1692, was very terrible, and its description sufficiently minute. "In two minutes' time it destroyed the town of Port Royal, and sunk the houses in a gulf forty fathoms deep. It was attended with a hollow rumbling noise, like that of thunder; and in less than a minute, three parts of the houses, and their inhabitants, were all sunk quite under water. While they were thus swallowed up on the one side of the street, on the other the houses were thrown into heaps; the sand of the streets rising like the waves of the sea, lifting up those that stood upon it, and immediately overwhelming them in pits. All the wells discharged their waters with the most vehement agitation. The sea felt an equal share of turbulence, and bursting over its mounds, deluged all that came in the way. The fissures of the earth were in some places so great, that one of the streets appeared twice as broad as formerly. In many places, however, it opened and closed again, and continued this agitation for some time. Of these openings, two or three hundred might be seen at a time; in some whereof the people were swallowed up; in others, the earth closing caught them by the middle, and thus crushed them instantly to death. Other openings, still more dreadful than the rest, swallowed up whole streets; and others, more formidable, spouted up whole cataracts of water, drowning such as the earthquake had spared. The whole was attended with the most noisome stench; while the thundering of the distant falling mountains, the whole sky overcast with a dusky gloom, and the crash of falling habitations, gave unspeakable horror to the scene. After this dreadful calamity was over, the whole island seemed converted into a scene of desolation; scarcely a planter's house was left standing; almost all were swallowed up; houses, people, trees, shared one universal ruin: and in their places appeared great pools of water, which when dried up by the sun, left only a plain of barren sand, without any vestige of former inhabitants. Most of the rivers, during the earthquake, were stopped up by the falling in of the mountains; and it was not till after some time they made themselves new channels. The mountains seemed particularly attacked by the force of the shock; and it was supposed that the principal seat of the concussion was among them. Those who were saved got on board ships in the harbour, where many remained above two months; the shocks continuing, during that interval, with more or less violence every day."

As this description seems to exhibit all the appearances that usually make up the catalogue of terrors belonging to an earthquake, I will suppress the detail of that which happened at Lisbon in our own times, and which is too recent to require a description. In fact, there are few particulars in the accounts of those who were present at that scene of desolation, that we have not more minutely and accurately transmitted to us by former writers, whose narratives I have for that reason preferred. I will therefore close this description of human calamities with the account of the dreadful earthquake at Calabria, in 1638. It is related by the celebrated Father Kircher, as it happened while he was on his journey to visit Mount Ætna, and the rest of the wonders that lie towards the south of Italy.

"Having hired a boat, in company with four more, two friars of the order of St Francis, and two seculars, we launched, on the twenty-fourth of March, from the harbour of Messina in Sicily, and arrived the same day at the promontory of Pelorus. Our destination was for the city of Euphæmia, in Calabria, where we had some business to transact, and where we designed to tarry for some time. However, Providence seemed willing to cross our design; for we were obliged to continue for three days at Pelorus, upon account of the weather; and though we often put out to sea, yet we were as often driven back. At length, however, wearied with the delay, we resolved to prosecute our voyage; and, although the sea seemed more than usually agitated, yet we ventured forward. The gulf of Charybdis, which we approached, seemed whirled round in such a manner, as to form a vast hollow, verging to a point in the centre. Proceeding onward, and turning my eyes to Ætna, I saw it cast forth large volumes of smoke, of mountainous sizes, which entirely covered the whole island, and blotted out the very shores from my view. This, together with the dreadful noise, and the sulphureous stench, which was strongly perceived, filled me with apprehensions that some more

---

unlike almost any other conditions of danger to human life, the deaths being greatly in excess of the injured. At Montemurro, a place of 7000 inhabitants, 5000 were killed by the falling houses, and 500 wounded.

In Britain repeated shocks of earthquakes have been experienced. In 1580, St. Paul's, in London, was injured by a concussion of the earth. In 1777, a slight shock was experienced at Manchester, extending one hundred and forty miles around. In 1795, another shock was felt through several counties of England.

In 1816, an earthquake occurred in the north of Scotland. At Inverness, the steeple of a church was twisted by its effects. Slight shocks are repeatedly experienced at Comrie, in Perthshire.

dreadful calamity was impending. The sea itself seemed to wear a very unusual appearance; those who have seen a lake in a violent shower of rain covered all over with bubbles, will conceive some idea of its agitations. My surprise was still increased by the calmness and serenity of the weather; not a breeze, not a cloud, which might be supposed to put all nature thus into motion. I therefore warned my companions that an earthquake was approaching; and, after some time, making for the shore with all possible diligence, we landed at Tropæ, happy and thankful for having escaped the threatening dangers of the sea.

"But our triumphs at land were of short duration: for we had scarcely arrived at the Jesuits' College in that city when our ears were stunned with a horrid sound, resembling that of an infinite number of chariots driven fiercely forward, the wheels rattling, and the thongs cracking, Soon after this, a most dreadful earthquake ensued, so that the whole tract upon which we stood, seemed to vibrate, as if we were in a scale of a balance that continued wavering. This motion, however, soon grew more violent: and being no longer able to keep my legs, I was thrown prostrate upon the ground. In the meantime, the universal ruin round me redoubled my amazement. The crash of falling houses, the tottering of towers, and the groans of the dying, all contributed to raise my terror and despair. On every side of me I saw nothing but a scene of ruin, and danger threatening wherever I should fly. I commended myself to God, as my last great refuge. At that hour, O how vain was every sublunary happiness! wealth, honour, empire, wisdom, all mere useless sounds, and as empty as the bubbles in the deep. Just standing on the threshold of eternity, nothing but God was my pleasure: and the nearer I approached, I only loved him the more.—After some time, however, finding that I remained unhurt amidst the general concussion, I resolved to venture for safety, and running as fast as I could, reached the shore, but almost terrified out of my reason. I did not search long here till I found the boat in which I had landed, and my companions also, whose terrors were even greater than mine. Our meeting was not of that kind where every one is desirous of telling his own happy escape; it was all silence, and a gloomy dread of impending terrors.

"Leaving this seat of desolation, we prosecuted our voyage along the coast, and the next day came to Rochetta, where we landed, although the earth still continued in violent agitations. But we were scarcely arrived at our inn, when we were once more obliged to return to the boat, and in about half an hour we saw the greatest part of the town, and the inn at which we had set up, dashed to the ground, and burying all its inhabitants beneath its ruins.

"In this manner, proceeding onward in our little vessel, finding no safety at land, and yet, from the smallness of our boat, having but a very dangerous continuance at sea, we at length landed at Lopizium, a castle midway between Tropæ and Euphæmia, the city to which, as I said before, we were bound. Here, wherever I turned my eyes, nothing but scenes of ruin and horror appeared; towns and castles levelled to the ground; Stromboli, though at sixty miles' distance, belching forth flames in an unusual manner, and with a noise which I could distinctly hear. But my attention was quickly turned from more remote to contiguous danger. The rumbling sound of an approaching earthquake, which we by this time were grown acquainted with, alarmed us for the consequences; it every moment seemed to grow louder, and to approach more near. The place on which we stood now began to shake most dreadfully, so that being unable to stand, my companions and I caught hold of whatever shrub grew next us, and supported ourselves in that manner.

"After some time, this violent paroxysm ceasing, we again stood up in order to prosecute our voyage to Euphæmia, that lay within sight. In the meantime, while we were preparing for this purpose, I turned my eyes towards the city, but could see only a frightful dark cloud that seemed to rest upon the place. This the more surprised us, as the weather was so very serene. We waited, therefore, till the cloud was passed away; then, turning to look for the city, it was totally sunk. Wonderful to tell! nothing but a dismal and putrid lake was to be seen where it stood. We looked about to find some that could tell us of its sad catastrophe, but could see none! All was become a melancholy solitude! a scene of hideous desolation! Thus proceeding pensively along, in quest of some human being that could give us some little information, we at length saw a boy sitting by the shore, and appearing stupified with terror. Of him, therefore, we inquired concerning the fate of the city, but he could not be induced to give us an answer. We intreated him with every expression of tenderness and pity to tell us: but his senses were quite wrapt up in the contemplation of the danger he had escaped. We offered him some victuals, but he seemed to loathe the sight. We still persisted in our offices of kindness; but he only pointed to the place of the city, like one out of his senses; and then running up into the woods, was never heard of after. Such was the fate of the city of Euphæmia! and as we continued our melancholy course along the shore, the whole coast, for the space of two hundred miles, presented nothing but remains of cities, and men scattered, without a habitation, over the fields. Proceeding thus along, we at length ended our distressful voyage by arriving at Naples, after having escaped a thousand dangers both at sea and land."

The reader, I hope, will excuse me for this long translation from a favourite writer, and that the sooner, as it contains some particulars relative to earthquakes not to be found elsewhere. From the whole of these accounts we may gather, that the most concomitant circumstances are these:—

A rumbling sound before the earthquake. This proceeds from the air, or fire, or both, forcing their way through the chasms of the earth, and endeavouring to get free; which is also heard in volcanoes.

A violent agitation or heaving of the sea, sometimes before and sometimes after that at land. This agitation is only a similar effect produced on the waters with that at land, and may be called, for the sake of perspicuity, a *seaquake;* and this also is produced by volcanoes.

A spouting up of waters to great heights. It is not easy to describe the manner in which this is performed: but volcanoes also perform the same; Vesuvius being known frequently to eject a vast body of water.

A rocking of the earth to and fro, and sometimes a perpendicular bouncing, if it may be so called, of the same. This difference chiefly arises from the situation of the place with respect to the subterranean fire. Directly under, it lifts; at a farther distance, it rocks.

Some earthquakes seem to travel onward, and are felt in different countries at different hours the same day. This arises from the great shock being given to the earth at one place, and that being communicated onward by an undulatory motion, successively affects different regions in its progress; as the blow given by a stone falling in a lake, is not perceived at the shores till some time after the first concussion.

The shock is sometimes instantaneous, like the explosion of gunpowder; and sometimes tremulous, and continuing for several minutes. The nearer the place where the shock is first given, the more instantaneous and simple it appears. At a greater distance, the earth redoubles the first blow with a sort of vibratory continuation.

As waters have generally so great a share in producing earthquakes, it is not to be wondered that they should generally follow those breaches made by the force of fire, and appear in the great chasms which the earthquake has opened.

These are some of the most remarkable phenomena of earthquakes, presenting a frightful assemblage of the most terrible effects of air, earth, fire, and water.

The valley of Solfatara, near Naples, seems to exhibit, in a minuter degree, whatever is seen of this horrible kind on the great theatre of nature. This plain, which is about twelve hundred feet long, and a thousand broad, is embosomed in mountains, and has in the middle of it a lake of noisome blackish water, covered with a bitumen, that floats upon its surface. In every part of this plain, caverns appear smoking with sulphur, and often emitting flames. The earth, wherever we walk over it, trembles beneath the feet. Noises of flames, and the hissing of waters, are heard at the bottom. The water sometimes spouts up eight or ten feet high. The most noisome fumes, fœtid water, and sulphureous vapours, offend the smell. A stone thrown into any of the caverns, is ejected again with considerable violence. These appearances generally prevail, when the sea is any way disturbed; and the whole seems to exhibit the appearance of an earthquake in miniature. However, in this smaller scene of wonders, as well as in the greater, there are many appearances for which, perhaps, we shall never account; and many questions may be asked, which no conjectures can thoroughly resolve. It was the fault of the philosophers of the last age, to be more inquisitive after the causes of things than after the things themselves. They seemed to think that a confession of ignorance cancelled their claims to wisdom; they, therefore, had a solution for every demand. But the present age has grown, if not more inquisitive, at least more modest; and none are now ashamed of that ignorance, which labour can neither remedy nor remove.

CHAP. XI.

OF THE APPEARANCE OF NEW ISLANDS AND TRACTS; AND OF THE DISAPPEARING OF OTHERS.

Hitherto we have taken a survey only of the evils which are produced by subterranean fires, but we have mentioned nothing of the benefits they may possibly produce. They may be of use in warming and cherishing the ground, in promoting vegetation, and giving a more exquisite flavour to the productions of the earth. The imagination of a person who has never been out of our own mild region, can scarcely reach to that luxuriant beauty with which all nature appears clothed in those very countries that we have but just now described as desolated by earthquakes, and undermined by subterranean fires. It must be granted, therefore, that though in those regions they have a greater share in the dangers, they have also a larger proportion in the benefits of nature.

But there is another advantage arising from subterranean fires, which, though hitherto disregarded by man, yet may one day become serviceable to him; I mean that while they are found to swallow up cities and plains in one place, they are also known to produce promontories and islands in another. We have many instances of islands being thus formed in the midst of the sea, which though for a long time barren, have afterwards become fruitful seats of happiness and industry.

New islands are formed in two ways: either suddenly, by the action of subterranean fires; or more slowly, by the deposition of mud, carried down by rivers, and stopped by some accident.[1] With respect particularly to the first, ancient historians, and modern travellers, give us such accounts as we can have no room to doubt of. Seneca assures us, that in his time the island of Therasia appeared unexpectedly to some mariners, as they were employed in another pursuit. Pliny assures us, that thirteen islands in the Mediterranean appeared at once emerging from the water; the cause of which he ascribes rather to the retiring of the sea in those parts, than to any subterraneous elevation. However, he mentions the island of Hiera, near that of Therasia, as formed by subterraneous explosions; and adds to his list several others formed in the same manner. In one of which he relates that fish in great abundance were found, and that all those who ate of them died shortly after.

"On the twenty-fourth of May,[2] in the year 1707, a slight earthquake was perceived at Santorin; and the day following, at sunrising, an object was seen by the inhabitants of that island, at two or three miles' distance at sea, which appeared like a floating rock. Some persons, desirous either of gain, or incited by curiosity, went there, and found, even while they stood upon this rock, that it seemed to rise beneath their feet. They perceived also, that its surface was covered with pumice-stones and oysters, which it had raised from the bottom. Every day after, until the fourteenth of June, this rock seemed considerably to increase; and then was found to be half a mile round, and about thirty feet above the sea. The earth of which it was composed seemed whitish, with a small proportion of clay. Soon after this the sea again appeared troubled, and streams arose which were very offensive to the inhabitants of Santorin. But on the sixteenth of the suceeding month, seventeen or eighteen rocks more were seen to rise out of the sea, and at length to join together. All this was accompanied with the most terrible noise, and fires which proceeded from the island that was newly formed. The whole mass, however, of all this new formed earth, uniting, increased every day, both in height and breadth, and, by the force of its explosions, cast forth rocks to seven miles' distance. This continued to bear the same dreadful appearances till the month of November in the same year; and it is at present a volcano, which sometimes renews its explosions. It is about three miles in circumference; and more than from thirty-five to forty feet high."

It seems extraordinary that about this place in particular, islands have appeared at different times, particularly that of Hiera, mentioned above, which has received considerable additions in succeeding ages. Justin tells us,[3] that at the time the Macedonians were at war with the Romans, a new island appeared between those of Theramenes and Therasia, by means of an earthquake. We are told that this became half as large again about a thousand years after, another island rising up by its side, and joining to it, so as scarcely at present to be distinguished from the former.

A new island was formed in the year 1720, near that of Tercera, near the continent of Africa, by the same causes. In the beginning of December, at night, there was a terrible earthquake at that place, and the top of a new island appeared, which cast forth smoke in vast quantities. The pilot of a ship, who approached it, sounded on one side of this island, and could not find ground at sixty fathom: at the other side, the sea was totally tinged of a different colour, exhibiting a mixture of white, blue, and green; and was very shallow. This island, on its first appearance, was larger than it is at present; for it has since that time sunk in such a manner, as to be scarcely above water.[4]

---

[1] Buffon, ii. 343.

[2] Hist. de l' Acad. an. 1708, p. 23.

[3] Justin, lib. xxx. cap. 4.

[4] In the year 1822, Chili was visited by a violent earthquake which raised the whole line of coast for the distance of above 100 miles to the height of 3 or 4 feet above its former level. Valparaiso is situated about the middle of the tract thus permanently elevated. A por-

A traveller, whom these appearances could not avoid affecting, speaks of them in this manner.[1] "What can be more surprising than to see fire not only break out of the bowels of the earth, but also to make itself a passage through the waters of the sea! What can be more extraordinary, or foreign to our common notions of things, than to see the bottom of the sea rise up into a mountain above the water, and to become so firm an island as to be able to resist the violence of the greatest storms! I know that subterraneous fires, when pent in a narrow passage, are able to raise up a mass of earth as large as an island: but that this should be done in so regular and exact a manner, that the water of the sea should not be able to penetrate and extinguish those fires; that after having made so many passages, they should retain force enough to raise the earth; and, in fine, after having been extinguished, that the mass of earth should not fall down, or sink again with its own weight, but still remain in a manner suspended over the great arch below! This is what to me seems more surprising than anything that has been related of Mount Ætna, Vesuvius, or any other volcano."

Such are his sentiments: however, there are few of these appearances any way more extraordinary than those attending volcanoes and earthquakes in general. We are not more to be surprised that inflammable substances should be found beneath the bottom of the sea, than at similar depths at land. These have all the force of fire giving expansion to air, and tending to raise the earth at the bottom of the sea, till it at length heaves above water. These marine volcanoes are not so frequent; for, if we may judge of the usual procedure of nature, it must very often happen, that before the bottom of the sea is elevated above the surface, a chasm is opened in it, and then the water pressing in, extinguishes the volcano before it has time to produce its effects. This extinction, however, is not effected without very great resistance from the fire beneath. The water, upon dashing into the cavern, is very probably at first ejected back with great violence; and thus some of those amazing water-spouts are seen, which have so often astonished the mariner, and excited curiosity. But of these in their place.

Besides the production of those islands by the action by fire, there are others, as was said, produced by rivers or seas carrying mud, earth, and such like substances, along with their currents; and at last depositing them in some particular place.[2] At the mouths of most great rivers, there are to be seen banks, thus formed by the sand and mud carried down by the stream, which have rested at that place, where the force of the current is diminished by its junction with the sea. These banks, by slow degrees, increase at the

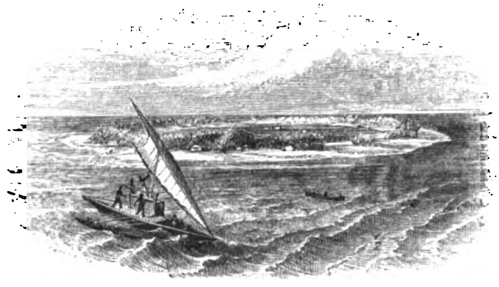
---

tion of Cutch, near the mouth of the Indus, underwent a similar revolution in the year 1819, when a district, nearly sixty miles in length by sixteen in breadth, was raised by an earthquake about ten feet above its original level. A volcanic eruption burst out in an adjoining part of India at Bhooi, at the exact period when the shocks of this earthquake terminated. The temple of Jupiter Serapis bears unequivocal evidence of the relative level of land and sea at Puzzuoli, having been twice changed since the Christian era, each movement of elevation and subsidence having exceeded twenty feet. The entire coast of the Bay of Baiæ presents proofs in its recent marine deposits, that it has participated in these changes. The surface of the pillars of the temple is smooth and uninjured to the height of twelve feet; above this is a zone of nine feet, pierced by a marine perforating bivalve, showing that the pillars must have been long immersed in sea-water, at a time when the lower part was protected by accumulated materials, marine and volcanic. The period of deepest depression has been traced to the latter part of the fifteenth century. The upward movement had begun in 1530, and the principal elevation occurred during the eruption of Monte Nuovo, in 1538. During the early part of the present century, it was proved that the ground was again sinking. In 1852, Lyell learned that the subsidence had ceased for several years. A similarly tranquil change in the relative level of the land and the sea has previously been referred to as in progress on the shores of Sweden, where the land has been observed for a century and a half to be rising at the rate of a few inches to several feet in a hundred years. Marks of a similar elevation occur on the shores of Norway.

[1] Phil. Trans. vol. v. p. 197.

[2] The influence exerted by organic agents in modifying the surface of the earth is nowhere more conspicuous than in the formation of coral islands and reefs in the seas of tropical regions. The oldest fossiliferous rocks, equally with the immense calcareous structures rising in the waters of the Pacific, bear testimony to the agency of frail and minute gelatinous animalcules having been employed in all ages in adding to the solid materials of the earth's crust. The limestones of the Silurian, Devonian, Carboniferous, and Cretaceous eras exhibit reefs of vast extent, not less distinctly coralline in their origin than the nascent islands in the South Seas. Owen notices that in the fields of Steeple-Ashton, every stone turned up by the plough is a coral, and that our inland quarries and chalk-pits afford to the palæontologist materials for the study of a class almost wholly awanting on the present shores of Europe. The coral zoophytes are chiefly species of Millepora, Porites, Madrepora, Caryophyllia, Meandrina, and Astrea. The margins of the reefs are often covered with Nullipores, marine vegetables enveloped in a crust of lime. The reefs consist of the accumulated calcareous skeletons of the zoophytes, and are classified under three heads, viz.: "atolls," "barrier reefs," and "fringing or shore reefs." The atolls or lagoon islands have attracted the most attention. Mr. Darwin remarks that "every one must be struck with astonishment when he first beholds one of these vast rings of coral rock, often many leagues in diameter, here and there surmounted by a low verdant island with dazzling white shores, bathed on the outside by the foaming breakers of the ocean, and on the inside surrounding a calm expanse of water, which, from reflection, is of a bright but pale green colour." The circular wall of the atoll is generally breached in one or more places

bottom of the deep: the water in those places is at first found by mariners to grow more shallow; the bank soon heaves up above the surface; it is considered, for a while, as a tract of useless and barren sand; but the seeds of some of the more hardy vegetables are driven thither by the wind, take root, and thus binding the sandy surface, the whole spot is



Atoll.

to a depth sufficient to admit a ship, which rides securely in the placid waters of the lagoon. These annular reefs, one of which is represented in the annexed cut, rise only a little above the water; the lake is usually shallow, but the reef is surrounded by a deep and often unfathomable ocean, the waves of which dash incessantly upon the submarine ramparts. And yet it is only on the outer edge, thus lashed by the breakers, that the reef is increased by the stony skeletons of the tender polypes, which choose their dwellings and spend their lives amidst the surges of an ocean that knows no rest. "It is impossible to behold them," says Mr. Darwin, "without feeling a conviction that rocks of granite or quartz would ultimately yield and be demolished by such irresistible forces. We see their soft and gelatinous bodies, through the agency of the vital laws, conquering the great mechanical power of the waves of an ocean which neither the art of man nor the inanimate works of nature could successfully resist." The scene presented by these circular reefs is described as being highly picturesque and striking. A strip of land a few hundred yards wide is covered by tall cocoa-nut palms; this zone of verdure is bounded by a beach of glittering white sand, the outer margin of which is encompassed by snowy breakers, with the dark heaving ocean beyond; the inner beach incloses the still waters of the lagoon; and over all is the blue vault of heaven. Beechy visited thirty-two of these coral islands in the Pacific, of which twenty-nine had lagoons in their centres. The largest was thirty miles in diameter, and the smallest less than a mile. A "barrier reef" runs parallel with the shores of some island or continent, from which it is separated by a broad and deep channel. "Fringing reefs" differ from the barrier reefs in being more immediately connected with the shore. The barrier reef on the west coast of New Caledonia is 400 miles in length; that of Australia extends with a few interruptions for nearly a thousand miles, its average distance from the land being twenty or thirty miles, and in some parts from fifty to seventy. The island of Mauritius exhibits an instance of a fringing or shore reef, which extends round its whole circumference. These different forms of the wonderful fabrications of the coral animalcules are explained by the following facts in their physiology. The animals of the Porites and Millepora are unable to exist at a greater depth than twenty or thirty fathoms; beyond this the effects of solar light and heat become too feeble to maintain their vitality, whereas a too direct exposure to the sun's rays becomes fatal to the delicate tissues of the animal. Hence, in whatever position the calcareous remains of the madrepore or millepore may be found, it is certain that they must have been developed within thirty fathoms of the surface of the sea. A stratum of coral has been found in the island of Tahiti, at an elevation of 5000 and 7000 feet above the level of the sea; and coralline remains have been brought up at Cardoo Atoll and Keeling Atoll from a depth of 200 or 300 fathoms. It is therefore inferred that the elevation of the former and the depression of the latter is due to the upheaval and the subsidence of the foundation upon which the living madrepore once flourished. It is in this way that Mr. Darwin accounts for the three different kinds of reefs, and his theory is now generally adopted by naturalists. According to this view, atolls rest on land which has subsided, and part of which was once dry. Barrier reefs show the islands or continents which they encircle to be the remains of land now partly submerged. Fringing reefs, on the other hand, indicate either that the shores are stationary, or that they are now rising, as in most of the Sandwich Islands, where former reefs have been elevated many yards above the sea. Keeping in view the ascertained fact that coral polypes can only exist at a depth of twenty or thirty fathoms, Mr. Darwin supposes that while they are still at work, the bottom of the sea begins gradually to subside. As the island sinks down, the living masses bathed by the surf on the margin of the reef will soon regain the surface, so that the foundation of their edifice will be carried down at the same time that they continue to raise the superstructure. If the rate of subsidence be not too rapid, the growing coral will continue to build up to the surface; and the structure will rise like a wall straight above the original base. The island, meanwhile, becomes less as it steadily subsides, and the water gains upon the shore, from which the fringing reef now stands out as a barrier reef. The subsidence continues till the island ultimately disappears, and the atoll alone remains to mark the outline of the shore where the reef-builders first began their upward labours.

Coral reefs are not composed exclusively of the skeletons of the coral zoophytes. Numerous shells, some of them of the largest known species, such as the Tridacna, contribute to augment the mass. Trunks of trees, floated from other islands, find a resting-place on the reef, which continues to accumulate the debris of coral and shells, till it at length rises above the surface of the water. A scanty vegetation takes possession of the new-born island, providing by its decay a soil suited for the growth of a higher race of plants. The seeds of the cocoa-nut palm, so admirably fitted by nature for floating uninjured in the sea, are drifted to the shore, and germinate in the virgin earth. "Even before the trees form a wood," says Chamisso, "the sea-birds nestle here; stray land-birds take refuge in the bushes; and, at a much later period, when the work has been long since completed, man appears and builds his hut on the fruitful soil."

The growth of coral reefs is confined to the warmer regions of the globe. The Bermuda Islands is the point furthest removed from the equator in which they have been found, and their occurrence so far northwards in this instance has been ascribed to the heat of the Gulf Stream. Some groups in the Pacific are about 1200 miles in length. The Australian reef is 1200 miles long, and averages thirty miles in width. From soundings made by Jukes, the depth of this submarine wall of coral cannot be less than 2000 feet. If the Australian reef could be transported to this part of the world, and on the supposition that it commenced at the north-west coast of France, it would encircle the British Islands, including Ireland, the Orkneys, and the Shetland Islands, and stretch on to Drontheim on the coast of Norway.

clothed in time with a beautiful verdure. In this manner there are delightful and inhabited islands at the mouths of many rivers, particularly the Nile, the Po, the Mississippi, the Ganges, and the Senegal. There has been, in the memory of man, a beautiful and large island formed in this manner at the mouth of the river Nanquin, in China, made from depositions of mud at its opening: it is not less than sixty miles long, and about twenty broad. La Loubere informs us,[1] in his voyage to Siam, that these sand-banks increase every day, at the mouths of all the great rivers in Asia; and hence, he asserts, that the navigation up these rivers becomes every day more difficult, and will, at one time or other, be totally obstructed. The same may be remarked with regard to the Wolga, which has at present seventy openings into the Caspian sea; and of the Danube, which has seven into the Euxine. We have had an instance of the formation of a new island not very long since at the mouth of the Humber, in England. "It is yet within the memory of man," says the relator,[2] "since it began to raise its head above the ocean. It began its appearance at low water for the space of a few hours, and was buried again till the next tide's retreat. Thus successively it lived and died, until the year 1666, when it began to maintain its ground against the insult of the waves, and then first invited the aid of human industry. A bank was thrown about its rising grounds, and being thus defended from the incursions of the sea, it became firm and solid, and, in a short time, afforded good pasturage for cattle. It is about nine miles in circumference, and is worth to the proprietor about eight hundred pounds a year." It would be endless to mention all the islands that have been thus formed, and the advantages that have been derived from them. However, it is frequently found, that new islands may often be considered as only turning the rivers from their former bed; so that in proportion as land is gained at one part, it is lost by the overflowing of some other.

Little, therefore, is gained by such accession; nor is there much more by the new islands which are sometimes formed from the spoils of the continent. Mariners assure us, that there are sometimes whole plains unrooted from the main lands, by floods and tempests. These being carried out to sea, with all their trees and animals upon them, are frequently seen floating in the ocean, and exhibiting a surprising appearance of rural tranquillity in the midst of danger. The greatest part, however, having the earth at their roots at length washed away, are dispersed and their animals drowned; but now and then some are found to brave the fury of the ocean, till being stuck either among rocks or sands, they again take firm footing, and become permanent islands.

As different causes have thus concurred to produce new islands, so we have accounts of others, that the same causes have contributed to destroy. We have already seen the power of earthquakes exerted in sinking whole cities, and leaving lakes in their room. There have been islands, and regions also, that have shared the same fate; and have sunk with their inhabitants never more to be heard of. Thus Pausanias[3] tells us of an island called Chrysis, that was sunk near Lemnos. Pliny mentions several; among others, the island of Cea, for thirty miles, having been washed away, with several thousands of its inhabitants. But of all the noted devastations of this kind, the total submersion of the island of Atalantis, as mentioned by Plato, has been most the subject of speculation. Mankind, in general, now consider the whole of his description as an ingenious fable; but when fables are grown famous by time and authority, they become an agreeable, if not a necessary, part of literary information.

"About nine thousand years are passed," says Plato,[4] "since the island of Atalantis was in being. The priests of Egypt were well acquainted with it; and the first heroes of Athens gained much glory in their wars with the inhabitants. This island was as large as Asia Minor and Syria united; and was situated beyond the Pillars of Hercules, in the Atlantic ocean. The beauty of the buildings, and the fertility of the soil, were far beyond any thing a modern imagination can conceive; gold and ivory were every where common; and the fruits of the earth offered themselves without cultivation. The arts and the courage of the inhabitants were not inferior to the happiness of their situation; and they were frequently known to make conquests, and overrun the continents of Europe and Asia." The imagination of the poetical philosopher riots in the description of the natural and acquired advantages, which they long enjoyed in this charming region. "If," says he, "we compare that country to our own, ours will appear a mere wasted skeleton, when opposed to it. Their mountains, to the very tops, were clothed with fertility, and poured down rivers to enrich the plains below."

---

[1] Lettres Curieuses et Edifiantes, sec. xi. p. 234.

[2] Phil Trans. vol. iv. p. 251.

[3] Pausanias, lib. 8. in Arcad. p. 509.

[4] Plato in Critia.

However, all these beauties and benefits were destroyed in one day by an earthquake sinking the earth, and the sea overwhelming it. At present not the smallest vestiges of such an island are to be found; Plato remains as the only authority for its existence; and philosophers dispute about its situation. It is not for me to enter into the controversy, when there appears but little probability to support the fact; and, indeed, it would be useless to run back nine thousand years in search of difficulties, as we are sursounded with objects that more closely affect us, and that demand admiration at our very doors. When I consider, as Lactantius suggests, the various vicissitudes of nature; lands swallowed by yawning earthquakes, or overwhelmed in the deep; rivers and lakes disappearing, or dried away; mountains levelled into plains; and plains swelling up into mountains; I cannot help regarding this earth as a place of very little stability; as a transient abode of still more transitory beings.

CHAP. XII.

OF MOUNTAINS.

Having at last, in some measure, emerged from the deeps of the earth, we come to a scene of greater splendour, the contemplation of its external appearance. In this survey its mountains are the first objects that strike the imagination, and excite our curiosity. There is not, perhaps, anything in all nature that impresses an unaccustomed spectator with such ideas of awful solemnity as these immense piles of Nature's erecting, that seem to mock the minuteness of human magnificence.

In countries where there are nothing but plains, the smallest elevations are apt to excite wonder. In Holland, which is all a flat, they show a little ridge of hills near the sea-side, which Boerhaave generally marked out to his pupils as being mountains of no small consideration. What would be the sensations of such an auditory could they at once be presented with a view of the heights and precipices of the Alps or the Andes! Even among us in England we have no adequate ideas of a mountain-prospect; our hills are generally sloping from the plain, and clothed to the very top with verdure; we can scarcely, therefore, lift our imaginations to those immense piles, whose tops peep up behind intervening clouds, sharp and precipitate, and reach to heights that human avarice or curiosity have never been able to ascend.

We in this part of the world are not, for that reason, so immediately interested in the question which has so long been agitated among philosophers concerning what gave rise to these inequalities on the surface of the globe. In our own happy region, we generally see no inequalities but such as contribute to use and beauty, and we therefore are amazed at a question inquiring how such necessary inequalities came to be formed, and seeming to express a wonder how the globe comes to be so beautiful as we find it. But though with us there may be no great cause for such a demand, yet in those places where mountains deform the face of nature, where they pour down cataracts, or give fury to tempests, there seems to be good reason for inquiry either into their causes or their uses. It has been, therefore, asked by many in what manner mountains have come to be formed, or for what uses they are designed.

To satisfy curiosity in these respects, much reasoning has been employed and very little knowledge propagated. With regard to the first part of the demand, the manner in which mountains were formed, we have already seen the conjectures of different philosophers on that head. One supposing that they were formed from the earth's broken shell at the time of the deluge; another, that they existed from the creation, and only acquired their deformities in process of time; a third, that they owed their original to earthquakes; and still a fourth, with much more plausibility than the rest, ascribing them entirely to the fluctuations of the deep, which he supposes in the beginning to have covered the whole earth. Such as are pleased with disquisitions of this kind may consult Burnet, Whiston, Woodward, or Buffon. Nor would I be thought to decry any mental amusements that at worst keep us innocently employed; but, for my own part, I cannot help wondering how the opposite demand has never come to be made, and why philosophers have never asked how we come to have plains. Plains are sometimes more prejudicial to man than mountains. Upon plains an inundation has greater power; the beams of the sun are often collected there with suffocating fierceness; they are sometimes found desert for several hundred miles together, as in the country east of the Caspian sea, although otherwise fruitful, merely because there are no risings or depressions to form reservoirs, or collect the smallest rivulet of water. The most rational answer, therefore, why either mountains or plains were formed, seems to be, that they were thus fashioned by the hand of Wisdom in order that pain and pleasure should be contiguous, as that morality might be exercised either in bearing the one or communicating the other.

Indeed, the more I consider this dispute respecting the formation of mountains the more I am struck with the futility of the question. There is neither a straight line nor an exact superficies in all nature. If we consider a circle, even with mathematical precision, we shall find it formed of a number of small right lines joining at angles together. These angles, therefore, may be considered in a circle as mountains are upon our globe, and to demand the reason for the one being mountainous or the other angular is only to ask why a circle is a circle or a globe is a globe. In short, if there be no surface without inequality in nature, why should we be surprised that the earth has such? It has often been said that the inequalities of its surface are scarce distinguishable if compared to its magnitude, and I think we have every reason to be content with the answer.

Some, however, have avoided the difficulty by urging the final cause. They allege that mountains have been formed merely because they are useful to man. This carries the inquirer but a part of the way; for no one can affirm that in all places they are useful. The contrary is known by horrid experience in those valleys that are subject to their influence. However, as the utility of our earthly habitation is a very pleasing and flattering speculation to every philosopher, it is not to be wondered that much has been said to prove the usefulness of these. For this purpose many conjectures have been made that have received a degree of assent even beyond their evidence, for men were unwilling to become more miserably wise.

It has been alleged as one principal advantage that we derive from them, that they serve like hoops or ribs to strengthen our earth and to bind it together. In consequence of this theory Kircher has given us a map of the earth in this manner hooped with its mountains, which might have a much more solid foundation did it entirely correspond with truth.

Others have found a different use for them, especially when they run surrounding our globe, which is, that they stop the vapours that are continually travelling from the equator to the poles; for these, being urged by the heat of the sun from the warm regions of the line, must all be accumulated at the poles if they were not stopped in their way by those high ridges of mountains which cross their direction. But an answer to this may be that all the great mountains in America lie lengthwise, and therefore do not cross their direction.

But, to leave these remote advantages, others assert that not only the animal but vegetable part of the creation would perish for want of convenient humidity were it not for their friendly assistance. Their summits are by these supposed to arrest, as it were, the vapours which float in the regions of the air. Their large inflections and channels are considered as so many basons prepared for the reception of those thick vapours and impetuous rains which descend into them. The huge caverns beneath are so many magazines or conservatories of water for the peculiar service of man; and those orifices by which the water is discharged upon the plain are so situated as to enrich and render them fruitful, instead of returning through subterraneous channels to the sea after the performance of a tedious and fruitless circulation.[1]

However this be, certain it is that almost all our great rivers find their source among mountains, and, in general, the more extensive the mountain, the greater the river: thus, the river Amazon, the greatest in the world, has its source among the Andes, which are the highest mountains on the globe; the river Niger travels a long course of several hundred miles from the Mountains of the Moon, the highest in all Africa; and the Danube and the Rhine proceed from the Alps, which are probably the highest mountains of Europe.

It needs scarcely be said that, with respect to height, there are many sizes of mountains, from the gently rising upland to the tall craggy precipice. The appearance is in general different in those of different magnitudes. The first are clothed with verdure to the very tops, and only seem to ascend to improve our prospects or supply us with a purer air; but the lofty mountains of the other class have a very different aspect. At a distance their tops are seen in wavy ridges, of the very colour of the clouds, and only to be distinguished from them by their figure, which, as I have said, resembles the billows of the sea.[2] As we approach, the mountain assumes a deeper colour; it gathers upon the sky, and seems to hide half the horizon behind it. Its summits also are become more distinct, and appear with a broken and perpendicular line. What at first seemed a single hill is now found to be a chain of continued mountains, whose tops, running along in ridges, are embosomed in each other; so that the curvatures of one are fitted to the prominences of the opposite side, and form a winding valley between, often of several miles in extent, and all the way continuing nearly of the same breadth.[1]

---

[1] Nature Displayed, vol. iii. p. 88.

[2] Lettres Philosophiques sur la Formation, &c. p. 106.

Nothing can be finer, or more exact, than Mr. Pope's description of a traveller straining up the Alps. Every mountain he comes to, he thinks will be the last; he finds, however, an unexpected hill rise before him; and that being scaled, he finds the highest summit almost at as great distance as before. Upon quitting the plain, he might have left a green and fertile soil, and a climate warm and pleas-

---

[1] Mountains owe their origin to the expansive force of subterranean heat in upheaving the beds of ancient seas. There is geological evidence to prove that this agency has operated successively after the deposition of the primary, the carboniferous, the cretaceous, and the tertiary strata. M. Elie de Beaumont professes to have established the existence of twelve distinct mountain-systems, of different ages, in Europe. Mountains, excepting those formed by volcanoes, are seldom isolated masses, rising from a plain, but they occur in groups, or succeed each other in a certain direction, in prolonged and lofty ridges, denominated mountain chains, and forming the axis or back-bone of a country. Subordinate ranges running in the same direction, and separated from the principal range by valleys of greater or less width, indicate the diminished intensity of the upheaving force, as the distance from each side of the central axis increases. The configuration of a country is determined by the direction of its mountain ranges; and its peculiar physiognomy depends not less upon the characteristic forms assumed by the rocks. Basalt rises in twin hills and truncated cones; porphyritic trap appears in grotesquely arranged towers and spires; ordinary greenstone in terraced masses; granite swells into rounded summits, capped with cyclopean walls, or fretted by atmospheric influences into alpine pinnacles; gneiss stretches into regions of rolling and bulky but shapeless hills; micaceous schist springs into sharp and picturesque peaks and craggy domes, with steep broken acclivities and serrated ridges; quartz rock ascends in conoidal shining hills, their barren slopes streaming with debris. The sedimentary formations are equally recognizable, from the forms peculiar to their hills and valleys. The undulating heights of the Silurian; tracts belted by the varying forms of the old red sandstone; the dislocated bands of the coal measures; the elevated hills, bold escarpments, and deep valleys of denudation of the oolite; and the long waving outlines of the chalk—all lend a characteristic feature to the landscape where they are developed. If a district of country thus derives its physical contour from the rocks of which it consists, the nature of the vegetation that clothes the surface is equally dependent, making due allowance for climate, upon the mineralogical composition of its underlying deposits. "The colouring of the landscape," to adopt the remark of Hugh Miller, "is well nigh as intimately connected with its geology as the drawing." And Humboldt, when speaking of the characteristic aspect of different portions of the earth's surface as depending conjointly on all external phenomena, observes, that "if the contours of the mountains, the physiognomy of plants and animals, the azure of the sky, the form of the clouds, and the transparency of the atmosphere, all combine in producing that general impression which is the result of the whole, yet it cannot be denied that the vegetable covering with which the surface of the earth is adorned, is the principal element in the impression."

The longest mountain range in the world is that of the Andes, in South America, forming an unbroken chain from one extremity of the country to the other. One of its loftiest summits is Chimborazo, which was long considered to be the highest mountain on the globe. This distinction now belongs to Mount Everest in the Himalaya range, which reaches the stupendous height of 29,002 feet; whereas the height of Chimborazo is 21,420, an altitude still 8000 ft. higher than Etna. Yet Mount Athos or the Righi piled upon the summit of Chimborazo would not reach an elevation equal to that of Mount Everest. Among the unmeasured giants of the Himalayas still loftier summits may yet be discovered. The highest ascertained peaks in the four divisions of the globe are—Mont Blanc (Europe), 15,372 ft.; Mount Everest (Asia), 29,002 ft.; Kilimanjaro (Africa, estimated) 20,000 ft.; and Aconcagua (South America), 23,910 ft.

The central nucleus or axis of many mountain districts consists of granite and other unstratified rocks, from which the strata are found declining or dipping at high angles. The elevation of the mountain ranges and the disturbance of the originally horizontal beds are to be ascribed to the same subterranean agency by which the granite itself was upheaved. Sometimes the granitic axis has burst through the superincumbent strata, and forms the summit of the mountain; at other times it is entirely covered over by the rocks which it has uplifted, but not perforated. Thus, in the mountain system of the Alps, granite and other plutonic rocks form the central axis; and the Grampians in Scotland, in like manner, constitute the nucleus of the chain of mountains stretching from the south-east to the north-west. Granite is found at the lowest depths and the greatest heights, and is of all ages; it is associated with the oldest fossiliferous strata, and penetrates the chalk and the earlier tertiary deposits. The relative ages of mountain systems is determined, therefore, not by the rock forming their central nucleus, but by the fossiliferous beds inclined upon its flanks. The most ancient ranges are those consisting of metamorphic strata, such as the gneisses and mica schists of the north of Scotland, of which Ben Nevis may be taken as an example, where the granite has burst through beds of gneiss and schist, and been in its turn penetrated by the huge prism of porphyry forming the upper part of the mountain. With a similar nucleus of granite, the Alps belong to the epoch of the latest grand paroxysm to which Europe has been subjected; and on the same evidence by which this convulsion is assigned to a period subsequent to the middle tertiary, the movement which elevated the Alps to their present height is proved to have extended to the immense range of the Himalaya. The elevation of the Andes has been much more recent. Mr. Darwin has adduced ample data in proof of the persistency of volcanic action throughout a long succession of geological periods, beginning with times antecedent to the deposition of the oolite and the chalk formations of Chili, and extending to the historical epoch. From personal observations made by this geologist, it appears that some of the parallel ridges of the Cordilleras, instead of being contemporaneous, were successively upheaved at widely different epochs. The entire range, after twice subsiding some thousands of feet, was again raised by a slow movement, during the era of the earliest of the tertiary formations, after which the whole was depressed once more to the extent of several hundred feet, to be again elevated to its present altitude. The Pyrenees, according to the age of the strata flanking the central nucleus, acquired their greatest height since the deposition of the oldest beds of the tertiary. The Apennines also chiefly rose to their present altitude within the tertiary epoch. Lyell infers from geological evidence that the Alps were raised to an additional height of 4000 feet, and in some places 10,000 feet, by subterranean convulsions occurring within the tertiary epoch. At the beginning of that epoch, it would appear that the Alps ing. As he ascends, the ground assumes a more russet colour; the grass becomes more mossy, and the weather more moderate. Still as he ascends, the weather becomes more cold, and the earth more barren. In this dreary passage he is often entertained with a little valley of surprising verdure, caused by the reflected heat of the sun collected into a narrow spot on the surrounding heights. But it much more frequently happens that he sees only frightful precipices beneath, and lakes of amazing depths; from whence rivers are formed, and fountains derive their original. On those places next the highest summits, vegetation is scarcely carried on; here and there a few plants of the most hardy kind appear. The air is intolerably cold; either continually refrigerated with frosts, or disturbed with tempests. All the ground here wears an eternal covering of ice and snows that seem constantly accumulating. Upon emerging from this war of the elements, he ascends into a purer and a serener region, where vegetation is entirely ceased; where the precipices, composed entirely of rocks, rise perpendicularly above him; while he views beneath him all the combat of the elements; clouds at his feet, and thunders darting upwards from their bosoms below.[1] A thousand meteors, which are never seen on the plain, present themselves. Circular rainbows;[2] mock suns; the shadow of the mountain projected upon the body of the air;[3] and the traveller's own image, reflected as in a looking-glass, upon the opposite cloud.[4]

Such are, in general, the wonders that present themselves to a traveller in his journey either over the Alps or the Andes. But we must not suppose that this picture exhibits either a constant or an invariable likeness ot those stupendous heights. Indeed, nothing can be more capricious or irregular than the forms of many of them. The tops of some run in ridges for a considerable length, without interruption; in others, the line seems indented by great valleys to an amazing depth. Sometimes a solitary and a single mountain rises from the bosom of the plain; and sometimes extensive plains, and even provinces, as those of Savoy and Quito, are found embosomed near the tops of mountains. In general, however, those countries that are most mountainous, are the most barren and uninhabitable.

If we compare the heights of mountains with each other, we shall find that the greatest and highest are found under the line.[5] It is thought by some that the rapidity of the earth's motion in these parts, together with the greatness of the tides there, may have thrown up those stupendous masses of earth. But, be the cause as it may, it is a remarkable fact, that the inequalities of the earth's surface are greatest there. Near the poles, the earth, indeed, is craggy and uneven enough; but the heights of the mountains there are very considerable. On the contrary, at the equator, where nature seems to sport in the amazing size of all her productions, the plains are extensive, and the mountains remarkably lofty. Some of them are known to rise three miles perpendicular above the bed of the ocean.

To enumerate the most remarkable of these, according to their size, we shall begin with the Andes, of which we have an excellent description by Ulloa, who went thither by command of the king of Spain, in company with the French academicians, to measure a degree of the meridian. His journey up these mountains is too curious not to give an extract from it.

---

and Carpathians, the Pyrenees and Apennines, had only been partially raised from the deep sea, although to a sufficient height, it is conjectured, to divide the ocean into limited seas, gulfs, and bays, in which the tertiary strata were to be deposited. Nummulitic limestone, of eocene tertiary age, enters largely into the structure of these mountain chains, and also constitutes many of the elevated lands of Africa and Asia. Mount Lebanon is supposed to belong to this system. The hills bounding the valley of the Nile are composed of nummulitic limestone, which was employed in the construction of the temples of Lower and Middle Egypt, and of several of the Pyramids. The hills of Palestine are of the chalk or oolite formation. The early history of the human race is therefore associated with a part of the world which had no existence at the period when the palæozoic rocks which now form the British Islands were uplifted from the bottom of the primeval seas.

Mountain chains present the steepest declivities on the sides nearest to the sea. The long chain of the Alleghany mountains, on the eastern side of America, forms a steep descent towards the Atlantic. On the other hand, the Rocky Mountains, which run near the north-west coast, and the Andes, near the Southern Pacific, are steepest on their western side. In ranges of mountains forming the boundaries of lakes, or of extensive level tracts through which large rivers flow, the mountains nearest to the rivers have the steepest declivities. The largest rivers have their sources in the sides of mountains which are most inclined to the horizon, and most remote from the sea.

The origin of valleys has occasioned much controversy amongst geologists. Hutton maintained that running water and atmospheric agency had excavated valleys. De Luc ascribed their formation to subsidence. Other geologists are of opinion that during the elevation of mountains, rocks of whatever structure must have been variously broken and fissured, and that some considerable effect would be produced on the forms of the ridges and hollows by the agitation of the water in the progress of upheaval. Something is also due to the action of the sea upon the rocks successively brought within range of its movements; and not a little to floods that have subsequently swept over and denuded the land.

[1] Ulloa, vol. i.

[2] Ibid.

[3] Phil. Trans. vol. v. p. 152.

[4] Ulloa.

[5] Buffon, passim.

After many incommodious days' sailing up the river Guayaquil, he arrived at Caracol, a town situated at the foot of the Andes. Nothing could exceed the inconveniences which he experienced in this voyage, from the flies and mosquitoes (an animal resembling our gnat). "We were the whole day," says he, "in continual motion to keep them off; but at night our torments were excessive. Our gloves, indeed, were some defence to our hands, but our faces were entirely exposed; nor were our clothes a sufficient defence for the rest of our bodies: for their stings penetrating through the cloth, caused a very painful and fiery itching. One night, in coming to an anchor near a large and handsome house that was uninhabited, we had no sooner seated ourselves in it, than we were attacked on all sides by swarms of mosquitoes, so that it was impossible to have one moment's quiet. Those who had covered themselves with clothes made for this purpose, found not the smallest defence: wherefore, hoping to find some relief in the open fields, we ventured out, though in danger of suffering in a more terrible manner from the serpents. But both places were equally obnoxious. On quitting this inhospitable retreat, we the next night took up our quarters in a house that was inhabited; the host of which being informed of the terrible manner we had past the night before, gravely told us, that the house we so greatly complained of, had been forsaken on account of its being the purgatory of a soul. But we had more reason to believe that it was quitted on account of its being the purgatory of the body. After having journeyed for upwards of three days, through boggy roads, in which the mules at every step sunk up to their bellies, we began at length to perceive an alteration in the climate; and having been long accustomed to heat, we now began to feel it grow sensibly colder.

"It is remarkable, that at Teriguagua we often see instances of the effects of two opposite temperatures, in two persons happening to meet: one of them leaving the plains below, and the other descending from the mountains. The former thinks the cold so severe, that he wraps himself up in all the garments he can procure; while the latter finds the heat so great, that he is scarce able to bear any clothes whatsoever. The one thinks the water so cold, that he avoids being sprinkled by it; the other is so delighted with its warmth, that he uses it as a bath. Nor is the case very different in the same person, who experiences the same diversity of sensation upon his journey up, and upon his return. This difference only proceeds from the change naturally felt at leaving a climate to which one has been accustomed, and coming into another of an opposite temperature.

"The ruggedness of the road from Teriguagua, leading up the mountain, is not easily described. In some parts the declivity is so great, that the mules can scarcely keep their footing; and in others, the acclivity is equally difficult. The trouble of having people going before to mend the road, the pains arising from the many falls and bruises, and the being constantly wet to the skin, might be supported, were not these inconveniences augmented by the sight of such frightful precipices, and deep abysses, as must fill the mind with ceaseless terror. There are some places where the road is so steep, and yet so narrow, that the mules are obliged to slide down, without making any use of their feet whatsoever. On one side of the rider, in this situation, rises an eminence of several hundred yards; and on the other, an abyss of equal depth; so that if he in the least checks his mule so as to destroy the equilibrium, they both must unavoidably perish.

"After having travelled about nine days in this manner, slowly winding along the side of the mountain, we began to find the whole country covered with a hoar frost; and a hut, in which we lay, had ice on it. Having escaped many perils, we at length, after a journey of fifteen days, arrived upon the plain, on the extremity of which stands the city of Quito, the capital of one of the most charming regions upon earth. Here, in the centre of the torrid zone, the heat is not only very tolerable, but in some places the cold also is painful. Here they enjoy all the temperature and advantages of perpetual spring; their fields being always covered with verdure, and enamelled with flowers of the most lively colours. However, although this beautiful region be higher than any other country in the world, and although it took up so many days of painful journey in the ascent, it is still overlooked by tremendous mountains; their sides covered with snow, and yet flaming with volcanoes at the top. These seemed piled one upon the other, and rise to a most astonishing height, with great coldness. However, at a determined point above the surface of the sea, the congelation is found at the same height in all the mountains. Those parts which are not subject to a continual frost, have here and there growing upon them a rush, resembling the genista, but much more soft and flexible. Towards the extremity of the part where the rush grows, and the cold begins to increase, is found a vegetable with a round bulbous head, which, when dried, becomes of amazing elasticity. Higher up, the earth is entirely bare of vegetation, and seems covered with eternal snow. The most remarkable mountains are, that of Cotopaxi (already described as a volcano), Chimborazo, and Pichincha. Cotopaxi is more than three geographical miles above the surface of the sea: the rest are not much inferior. On the top of the latter was my station for measuring a degree of the meridian; where I suffered particular hardships from the intenseness of the cold, and the violence of the storms. The sky round was, in general, involved in thick fogs, which, when they cleared away, and the clouds, by their gravity, moved nearer to the surface of the earth, they appeared surrounding the foot of the mountain, at a vast distance below, like a sea, encompassing an island in the midst of it. When this happened, the horrid noises of tempests were heard from beneath, then discharging themselves on Quito, and the neighbouring country. I saw the lightnings issue from the clouds, and heard the thunders roll far beneath me. All this time, while the tempest was raging below, the mountain top, where I was placed, enjoyed a delightful serenity; the wind was abated; the sky clear; and the enlivening rays of the sun moderated the severity of the cold. However, this was of no very long duration, for the wind returned with all its violence, and with such velocity as to dazzle the sight; whilst my fears were increased by the dreadful concussions of the precipice, and the fall of enormous rocks; the only sounds that were heard in this frightful situation."

Such is the animated picture of these mountains, as given us by this ingenious Spaniard: and I believe the reader will wish that I had made the quotation still longer. A passage over the Alps, or a journey across the Pyrenees, appear petty trips or excursions in the comparison; and yet these are the most lofty mountains we know of in Europe.

If we compare the Alps with the mountains already described, we shall find them but little more than one half of the height of the former. The Andes, upon being measured by the barometer, are found above three thousand one hundred and thirty-six toises or fathoms above the surface of the sea.[1] Whereas the highest point of the Alps is not above sixteen hundred. The one, in other words, is above three miles high; the other about a mile and a half. The highest mountains in Asia are Mount Taurus, Mount Imaus, Mount Caucasus, and the mountains of Japan.[2] Of these, none equals the Andes in height; although Mount Caucasus, which is the highest of them, makes very near approaches. Father Verbeist tells of a mountain in China, which he measured, and found a mile and a half high.[3] In Africa, the mountains of the Moon, famous for giving source to the Niger and the Nile, are rather more noted than known. Of the Peak of Teneriffe, one of the Canary Islands that lie off this coast, we have more certain information. In the year 1727, it was visited by a company of English merchants, who travelled up to the top, where they observed its height, and the volcano on its very summit.[4] They found it a heap of mountains, the highest of which rises over the rest like a sugar-loaf, and gives a name to the whole mass. It is computed to be a mile and a half perpendicular from the surface of the sea. Kircher gives us an estimate of the heights of most of the other great mountains in the world; but as he has taken his calculations in general from the ancients, or from modern travellers, who had not the art of measuring them, they are quite incredible. The art of taking the heights of places by the barometer, is a new and an ingenious invention. As the air grows lighter as we ascend, the fluid in the tube rises in due proportion: thus the instrument being properly marked, gives the height with a tolerable degree of exactness; at least enough to satisfy curiosity.

Few of our great mountains have been estimated in this manner; travellers having, perhaps, been deterred, by a supposed impossibility of breathing at the top. However, it has been invariably found, that the air in the highest that our modern travellers have ascended, is not at all too fine for respiration. At the top of the Peak of Teneriffe, there was found no other inconvenience from the air, except its coldness; at the top of the Andes, there was no difficulty of breathing perceived. The accounts, therefore, of those who have asserted that they were unable to breathe, though at much less heights, are greatly to be suspected. In fact it is very natural for mankind to paint those obstacles as insurmountable, which they themselves have not had the fortitude or perseverance to surmount.

The difficulty and danger of ascending to the tops of mountains proceeds from other causes, not the thinness of the air. For instance, some of the summits of the Alps have never yet been visited by man. But the reason is, that they rise with such a rugged and precipitate ascent, that they are utterly inaccessible. In some places they appear like a great wall of six or seven hundred feet high; in others, there stick out enormous rocks, that hang upon the brow of the steep, and every moment threaten destruction to the traveller below.

---

[1] Ulloa, vol. i. p. 442.

[2] The Himalaya Mountains between Hindoostan and Thibet are the highest in the world. The highest of the Himalaya exceeds that of the Andes about 7000 feet. The reader is referred to Plate VI. for a comparative view of the heights of the principal mountains in the world, with their absolute heights specified below.

[3] Verbiest, à la Chine.

[4] Phil. Trans. vol. v.

In this manner almost all the tops of the highest mountains are bare and pointed. And this naturally proceeds from their being so continually assaulted by thunders and tempests. All the earthy substances with which they might have been once covered, have for ages been washed away from their summits; and nothing is left remaining but immense rocks, which no tempest has hitherto been able to destroy.

Nevertheless, time is every day, and every hour, making depredations; and huge fragments are seen tumbling down the precipice, either loosened from the summit by frost or rains, or struck down by lightning. Nothing can exhibit a more terrible picture than one of these enormous rocks, commonly larger than a house, falling from its height, with a noise louder than thunder, and rolling down the side of the mountain. Dr. Plot tells us of one in particular, which being loosened from its bed, tumbled down the precipice, and was partly shattered into a thousand pieces. Notwithstanding, one of the largest fragments of the same, still preserving its motion, travelled over the plain below, crossed a rivulet in the midst, and at last stopped on the other side of the bank! These fragments, as was said, are often struck off by lightning, and sometimes undermined by rains; but the most usual manner in which they are disunited from the mountain, is by frost: the rains insinuating between the interstices of the mountain, continue there until there comes a frost, and then, when converted into ice, the water swells with an irresistible force, and produces the same effect as gunpowder, splitting the most solid rocks, and thus shattering the summits of the mountain.

But not rocks alone, but whole mountains are, by various causes, disunited from each other. We see in many parts of the Alps, amazing clefts, the sides of which so exactly correspond with the opposite, that no doubt can be made of their having been once joined together. At Cajeta,[1] in Italy, a mountain was split in this manner by an earthquake; and there is a passage opened through it, that appears as if elaborately done by the industry of man. In the Andes these breaches are frequently seen. That at Thermopylæ, in Greece, has long been famous. The mountain of the Troglodytes, in Arabia, has thus a passage through it: and that in Savoy, which nature began, and which Victor Amadeus completed, is an instance of the same kind.

We have accounts of some of these disruptions, immediately after their happening. "In the month of June,[2] in the year 1714, a part of the mountain of Diableret, in the district of Valais, in France, suddenly fell down between two and three o'clock in the afternoon, the weather being very calm and serene. It was of a conical figure, and destroyed fifty-five cottages in the fall. Fifteen persons, together with about a hundred beasts, were also crushed beneath its ruins, which covered in extent a good league square. The dust it occasioned instantly covered all the neighbourhood in darkness. The heaps of rubbish were more than three hundred feet high. They stopped the current of a river that ran along the plain, which is now formed into several new and deep lakes. There appeared through the whole of this rubbish none of those substances that seemed to indicate that this disruption had been by means of subterraneous fires. Most probably, the base of this rocky mountain was rotted and decayed; and thus fell without any extraneous violence." In the same manner, in the year 1618, the town of Pleurs, in France, was buried beneath a rocky mountain, at the foot of which it was situated.[3]

These accidents, and many more that might be enumerated of the same kind, have been produced by various causes: by earthquakes, as in the mountain at Cajeta; or being decayed at the bottom, as at Diableret. But the most general way is, by the foundation of one part of the mountain being hollowed by waters, and thus wanting a support, breaking from the other. Thus it generally has been found in the great chasms in the Alps; and thus it always is known in those disruptions of hills, which are known by the name of land-slips. These are nothing more than the slidings down of a higher piece of ground, disrooted from its situation by subterraneous inundations, and settling itself upon the plain below.

---

[1] Buffon, vol. ii. p. 364.

[2] Hist. de l'Academie des Sciences, p. 4, An. 1715.

[3] In 1806, an immense projection of the mountain of Rufiberg in Switzerland, was precipitated into the valley of Lowertz. It overwhelmed three villages, and part of two others. Four hundred and thirty-four individuals perished, and the loss to property was estimated at £120,000.

There is not an appearance in all nature that so much astonished our ancestors as these land-slips. In fact, to behold a large upland, with its houses, its corn, and cattle, at once loosened from its place, and floating, as it were, upon the subjacent water; to behold it quitting its ancient situation, and travelling forward like a ship in quest of new adventures; this is certainly one of the most extraordinary appearances that can be imagined; and to a people ignorant of the powers of nature, might well be considered as a prodigy. Accordingly, we find all our old historians mentioning it as an omen of approaching calamities. In this more enlightened age, however, its cause is very well known; and, instead of exciting ominous apprehensions in the populace, it only gives rise to some very ridiculous law-suits among them, about whose the property shall be; whether the land which has thus slipt shall belong to the original possessor, or to him upon whose grounds it has encroached and settled. What has been the determination of the judges, is not so well known, but the circumstances of the slips have been minutely and exactly described.

In the lands of Slatberg,[1] in the kingdom of Iceland, there stood a declivity, gradually ascending for near half a mile. In the year 1713, and on the 10th of March, the inhabitants perceived a crack on its side, somewhat like a furrow made with a plough, which they imputed to the effects of lightning, as there had been thunder the night before. However, on the evening of the same day, they were surprised to hear a hideous confused noise issuing all round from the side of the hill; and their curiosity being raised, they resorted to the place. There, to their amazement, they found the earth for near five acres, all in gentle motion, and sliding down the hill upon the subjacent plain. This motion continued the remaining part of the day, and the whole night; nor did the noise cease during the whole time, proceeding, probably, from the attrition of the ground beneath. The day following, however, this strange journey down the hill ceased entirely; and above an acre of the meadow below was found covered with what before composed a part of the declivity.

However, these slips, when a whole mountain's side seems to descend, happen but very rarely. There are some of another kind, however, much more common; and as they are always sudden, much more dangerous. These are snow-slips, well known, and greatly dreaded by travellers. It often happens when snow has long been accumulated on the tops and on the sides of mountains, it is borne down the precipice, either by means of tempests, or its own melting. At first, when loosened, the volume in motion is but small; but gathers as it continues to roll; and by the time it has reached the habitable parts of the mountain, is generally grown of enormous bulk. Wherever it rolls, it levels all things in its way, or buries them in unavoidable destruction. Instead of rolling, it sometimes is found to slide along from the top; yet even thus it is generally as fatal as before. Nevertheless, we have had an instance, a few years ago, of a small family in Germany, that lived for above a fortnight beneath one of these snow-slips. Although they were buried during that whole time in utter darkness, and under a bed of some hundred feet deep, yet they were luckily taken out alive; the weight of the snow being supported by a beam that kept up the roof; and nourishment being supplied them by the milk of an ass, if I remember right, that was buried under the same ruin.

But it is not the parts alone that are thus found to subside, whole mountains have been known totally to disappear. Pliny tells us,[2] that in his own time the lofty mountain of Cybotus, together with the city of Eurites, were swallowed by an earthquake. The same fate, he says, attended Phlegium, one of the highest mountains in Ethiopia; which after one night's concussion was never seen more. In modern times, a very noted mountain in the Molucca islands, known by the name of the *Peak*, and remarkable for being seen at a very great distance from sea, was swallowed by an earthquake; and nothing but a lake was left in the place where it stood. Thus, while storms and tempests are levelled against mountains above, earthquakes and waters are undermining them below. All our histories talk of their destruction; and very few new ones (if we except Mount Cenere, and one or two such heaps of cinders,) are produced. If mountains, therefore, were of such great utility as some philosophers make them to mankind, it would be a very melancholy consideration that such benefits were diminishing every day. But the truth is, the valleys are fertilized by that earth which is washed from their sides; and the plains become richer, in proportion as the mountains decay.[3]

---

[1] Phil. Trans. vol. iv. p. 250.

[2] Plin. lib. ii. cap. 93.

[3] The phenomena of *glaciers*, those vast masses of ice accumulated in the valleys and on the slopes of lofty mountains, have attracted attention only within a comparatively recent period. The glaciers of the Swiss Alps were first described by Saussure, and within the last few years by Agassiz, Forbes, Hopkins, and others The formation of glaciers is due to the snow falling in

CHAP. XIII.

OF WATER.

In contemplating nature, we shall often find the same substances possessed of contrary qualities, and producing opposite effects. Air which liquefies one substance, dries up another. That fire which is seen to burn up the desert, is often found in other places to assist the luxuriance of vegetation; and water which, next to fire, is the most fluid substance upon earth, nevertheless gives all other bodies their firmness and durability; so that every element seems to be a powerful servant, capable either of good or ill, and only awaiting external direction to become the friend or the enemy of mankind. These opposite qualities, in this substance in particular, have not failed to excite the admiration and inquiry of the curious.

That water is the most fluid penetrating body, next to fire, and the most difficult to confine, is incontestably proved by a variety of experiments. A vessel through which water cannot pass, may be said to retain any thing. It may be objected, indeed, that syrups, oils, and honey, leak through some vessels that water cannot pass through; but this is far from being the result of the greater tenuity and fineness of their parts; it is owing to the rosin wherewith the wood of such vessels abounds, which oils and syrups have a power of dissolving; so that these fluids, instead of finding their way, may more properly be said to eat their way, through the vessels that contain them. However, water will at last find its way even through these; for it is known to escape through vessels of every substance, glass only excepted. Other bodies may be found to make their way out more readily indeed; as air, when it finds a vent, will escape at once: and quicksilver, because of its weight, quickly penetrates through whatever chinky vessel confines it: but water, though it operates more slowly, yet always finds a more certain issue. As, for instance, it is well known that air will not pass through leather; which water will very readily penetrate. Air also may be retained in a bladder; but water will quickly ooze through. And those who drive this to the greatest degree of precision, pretend to say, that it will pass through pores ten times smaller than air can do. Be this as it may, we are very certain that its parts are so small, that they have been actually driven through the pores of gold. This has been proved by the famous Florentine experiment, in which a quantity of water was shut up in a hollow ball of gold, and then pressed with a huge force by screws, during which the fluid was seen to ooze through the pores of the metal, and to stand, like a dew, upon its surface.

As water is thus penetrating, and its parts thus minute, it may easily be supposed that they enter into the composition of all bodies, vegetable, animal, and fossil. This every chemist's experience convinces him of; and the mixture is the more obvious, as it can always be separated, by a gentle heat, from those substances with which it had been united. Fire, as was said, will penetrate where water cannot pass; but then it is not so easily to be separated. But there is scarce any substance from which its water cannot be divorced. The parings or filings of lead, tin, and antimony, by distillation, yield water plentifully: the hardest stones, sea-salt, nitre, vitriol, and sulphur, are found to consist chiefly of water; into which they resolve by force of fire. "All birds, beasts, and fishes," says Newton, "insects, trees, and vegetables, with their parts, grow from water; and, by putrefaction, return to water

---

winter in the higher regions of the mountains, and which the warmth of summer is incapable of dissolving. The snow is ultimately converted into a viscous or semi-fluid ice, porous and opaque, the entire mass of which gradually descends towards the plain. Being constantly fed by the snows of winter, the glaciers are of incalculable age, and in incessant although imperceptible motion. They are often traversed by crevasses or chasms, sometimes a hundred feet deep, and which, when covered by snow, are sources of danger to travellers ascending the Alps. The rocks bordering the glacier are fractured and disintegrated in its downward course, and the debris gathers to a height of many feet on its sides, in the form of long dykes or parapets, which have received the name of lateral moraines. Terminal moraines are formed of the same materials, carried down to the plain and deposited by the thawing ice, where also water of a whitish-blue colour gushes out in plenteous streams from below the glacier, its lower surface being dissolved by coming into contact with the ground. The cause of the descent of glaciers has given rise to much speculation. Saussure ascribed the motion simply to the effect of gravity; Charpentier, to internal expansion occasioned by the freezing of water penetrating the internal cavities; Forbes, to the united effect of viscosity and gravity. Agassiz believes the transportation of blocks of rock to great distances in the Swiss valleys and plains to have been caused by ancient glaciers, the motion, as he supposes, being due to the congelation of water in minute capillary fissures and spaces in the ice, producing an expansive power capable of propelling the glacier over level countries, thus accounting for travelled boulders, grooved, striated, and smoothed rocks, and other traces of ancient glacial action in various parts of Europe. From Mont Blanc to the borders of the Tyrol, there are about 400 glaciers, ranging from 10 to 15 miles in length, with a breadth of 1 mile to 2½ miles. The Alpine glaciers constitute the reservoirs in which some of the greatest rivers in Europe take their rise. In Plate I is represented the Glacier of Bossons, in the valley of Chamouni.

again." In short, almost every substance that we see, owes its texture and firmness to the parts of water that mix with its earth; and, deprived of this fluid, it becomes a mass of shapeless dust and ashes.

From hence we see, as was above hinted, that this most fluid body, when mixed with others, gives them consistence and form. Water, by being mixed with earth or ashes, and formed into a vessel, when baked before the fire, becomes a coppel, remarkable for this, that it will bear the utmost force of the hottest furnace that art can contrive. So the Chinese earth, of which porcelain is made, is nothing more than an artificial composition of earth and water, united by heat; and which a greater degree of heat could easily separate. Thus we see a body, extremely fluid of itself, in some measure assuming a new nature, by being united with others: we see a body, whose fluid and dissolving qualities are so obvious, giving consistence and hardness to all the substances of the earth.

From considerations of this kind, Thales, and many of the ancient philosophers, held that all things were made of water. In order to confirm this opinion, Helmot made an experiment, by divesting a quantity of earth of all its oils and salts, and then putting this earth, so prepared, into an earthen pot, which nothing but rain-water could enter, and planting a willow therein; this vegetable, so planted, grew up to a considerable height and bulk, merely from the accidental aspersion of rain-water; while the earth, in which it was planted, received no sensible diminution. From this experiment, he concluded, that water was the only nourishment of the vegetable tribe; and that vegetables, being the nourishment of animals, all organized substances, therefore, owed their support and being only to water. But this has been said by Woodward to be a mistake; for he shows, that water being impregnated with earthy particles, is only the conveyer of such substances into the pores of vegetables, rather than an increaser of them by its own bulk: and likewise, that water is ever found to afford so much less nourishment, in proportion as it is purified by distillation. A plant in distilled water will not grow so fast as in water not distilled; and if the same be distilled three or four times over, the plant will scarcely grow at all, or receive any nourishment from it. So that water, as such, does not seem the proper nourishment of vegetables, but only the vehicle thereof, which contains the nutritious particles, and carries them through all parts of the plant. Water, in its pure state, may suffice to extend or swell the parts of a plant, but affords vegetable matter in a moderate proportion.

However this be, it is agreed on all sides, that water, such as we find it, is far from being a pure simple substance.[1] The most genuine we know is mixed with exhalations and dissolutions of various kinds; and no expedient that has been hitherto discovered, is capable of purifying it entirely. If we filter and distil it a thousand times, according to Boerhaave, it will still deposit a sediment; and by repeating the process we may evaporate it entirely away, but can never totally remove its impurities. Some, however, assert, that water, properly distilled, will have no sediment;[2] and that the little white speck which is found at the bottom of the still, is a substance that enters from without. Kircher used to show, in his Museum, a phial of water that had been kept for fifty years, hermetically sealed;[3] during which it had deposed no sediment, but continued as transparent as when first it was put in. How far, therefore, it may be brought to a state of purity by distillation, is unknown; but we very well know, that all such water as we everywhere see, is a bed in which plants, minerals, and animals are all found confusedly floating together.

Rain-water, which is a fluid of Nature's own distilling, and which has been raised so high by evaporation, is nevertheless a very mixed and impure substance. Exhalations of all kinds, whether salts, sulphurs, or metals, make a part of its substance, and tend to increase its weight. If we gather the water that falls, after a thunder-clap, in a sultry summer's day, and let it settle, we shall find a real salt sticking at the bottom. In winter, however, its impure mixtures are fewer, but still may be separated by distillation. But as to that which is generally caught pouring from the tops of houses, it is particularly foul, being impregnated with the smoke of the chimneys, the vapour of the slates or tiles, and with other impurities that birds and animals may have deposited there. Besides, though it should be supposed free from all these, it is mixed with a quantity of air, which, after being kept for some time, will be seen to separate.[1]

---

[1] Water, irrespective of the impurities it may hold in suspension or solution, is composed of the two gases, oxygen and hydrogen, in the following proportions: oxygen, 88·9; hydrogen, 11·1. Rain collected after a shower has continued for some time, is pure water, excepting for the air it contains. But whenever it comes into contact with the soil, it is impregnated with various earthy and organic matters, from which it can only be purified by distillation.

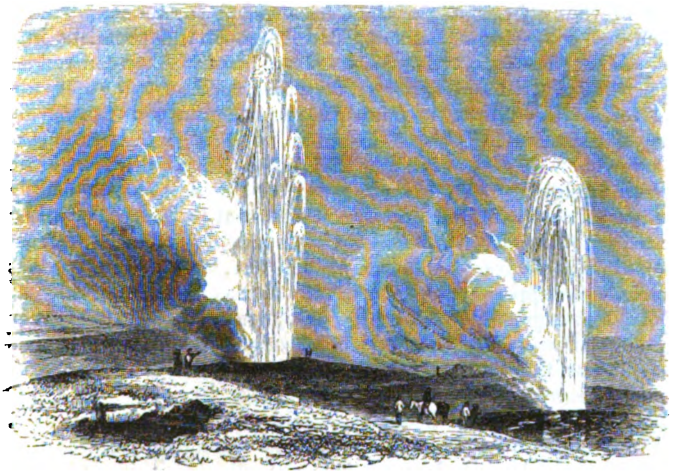
[2] Hill's History of Fossils.

[3] Hermetically sealing a glass vessel, means no more than heating the mouth of the phial red hot; and thus when the glass is become pliant, squeezing the mouth together with a pair of pincers, and then twisting it six or seven times round, which effectually closes it up. *Note by Goldsmith.*

Spring-water is next in point of purity. This, according to Dr. Halley, is collected from the air itself; which, being sated with water, and coming to be condensed by the evening's cold, is driven against the tops of the mountains, where, being condensed and collected, it trickles down by the sides into the cavities of the earth, and running for a while underground bubbles up in fountains upon the plain. This having made but a short circulation has generally had no long time to dissolve or imbibe any foreign substances by the way.

River-water is generally more foul than the former. Wherever the stream flows it receives a tincture from its channel. Plants, minerals, and animals, all contribute to add to its impurities; so that such as live at the mouths of great rivers are generally subject to all those disorders which contaminated and unwholesome waters are known to produce. Of all the river-water in the world that of the Indus and the Thames is said to be the most light and wholesome.

The most impure fresh water that we know is that of stagnating pools and lakes, which, in summer, may be more properly considered as a jelly of floating insects than a collection of water.[2] In this millions of little reptiles, undisturbed by any current, which might crush their frames to pieces, breed and engender. The whole teems with shapeless life, and only grows more fruitful by increasing putrefaction.



The Great Geyser, Iceland.

Of the purity of all these waters, the lightness and not the transparency ought to be the test. Water may be extremely clear and beautiful to the eye, and yet very much impregnated with mineral particles. In fact, sea-water is the most transparent of any, and yet it is well known to contain a large mixture of salt and bitumen. On the contrary, those waters which are lightest have the fewest dissolutions floating in them, and may, therefore, be the most useful for all the purposes of life. But, after all, though much has been said upon this subject, and although waters have been weighed with great assiduity to determine their degree of salubrity, yet neither this, nor their curdling with soap, nor any other philosophical standard whatsoever, will answer the purposes of true information. Experience alone ought to determine the useful or noxious qualities of every spring, and experience assures us that different kinds of water are adapted to different constitutions. An incontestible proof of this are the many medicinal springs throughout the world, whose peculiar benefits are known to the natives of their respective countries. These are of various kinds, according to the different minerals with which they are impregnated—hot, saline, sulphureous, bituminous, and oily. But the account of these will come most properly under that of the several minerals by which they are produced.

---

[1] The water which circulates on the surface of the globe has generally no other principle of motion than its own specific gravity, and the declivity of the earth. It is this declivity which carries it from mountain to mountain, from valley to valley, until it falls into the basin of the ocean.

The *spouting springs*, which sometimes form natural jets of water, follow the same rules of equilibrium as the others, except that the canals which furnish them with water come from great elevations, and with a rapid descent. Waters thus carried into a subterraneous reservoir, finding themselves closely confined, burst forth in consequence of the pressure, just like those water-spouting fountains and works with which art embellishes our gardens. *Springs of boiling water*, which appear to accompany the volcanoes, probably obey the same laws. A French naturalist, however, is of opinion, that the majestic phenomena of the spring called the Geyser, in Iceland, are produced by subterranean vapours, which suddenly bursting forth, raise an immense body of water resembling the ancient crater of a volcano. But it is more probable that this spring receives its waters from the neighbouring heights.

The *intermitting fountains*, particularly such as rise and fall at regular periods, so excited the wonder of the people, that they gave them the name of *miraculous fountains*. The periodical fountain of Como in Italy, has been described by Pliny; it rises and falls every hour. There is another in the town of Colmars, in Provence, which rises eight times in an hour. There is one at Fronzanches, in Languedoc, the period of whose rising is each day fifty minutes later than the preceding day. The *round fountain*, on the road from Pontarlier to Touillon, in Franche-Comte, rises with a boiling appearance. The *Buller-born*, in the bishopric of Paderborn, in Westphalia, rises with great noise. Near Brest, there is a well seventy-five feet from the sea, which sinks with the flow and rises with the ebbing of the sea. England furnishes many examples of these springs, one particularly near Torbay, in Devonshire, and one at Buxton, in Derbyshire.

[2] A quantity of charcoal thrown into putrid water renders the water sweet in a few hours.

After all, therefore, we must be contented with but an impure mixture of our daily beverage. And yet, perhaps, this very mixture may often be more serviceable to our health than that of a purer kind. We know that it is so with regard to vegetables, and why not also in general to man? Be this as it will, if we are desirous of having water in its greatest purity, we are ordered by the curious in this particular to distil it from snow gathered upon the tops of the highest mountains, and to take none but the outer and superficial part thereof. This we must be satisfied to call pure water; but even this is far short of the pure, unmixed, philosophical element, which, in reality, is nowhere to be found.

As water is thus mixed with foreign matter, and often the repository of minute animals or vegetable seeds, we need not be surprised that, when carried to sea, it is always found to putrify. But we must not suppose that it is the element itself which thus grows putrid and offensive, but the substances with which it is impregnated. It is true, the utmost precautions are taken to destroy all vegetable and animal substances that may have previously been lodged in it by boiling; but, notwithstanding this, there are some that will still survive the operation, and others that find their way during the time of its stowage. Seamen, therefore, assure us that their water is generally found to putrify twice at least, and sometimes three times in a long voyage. In about a month after it has been at sea, when the bung is taken out of the cask it sends up a noisome and dangerous vapour, which would take fire upon the application of a candle.[1] The whole body of the water then is found replete with little worm-like insects, that float with great briskness through all its parts. These generally live for about a couple of days, and then dying, by depositing their spoils, for a while increase the putrefaction. After a time the heavier parts of these sinking to the bottom, the lighter float in a scum at the top, and this is what the mariners call the water's purging itself. There is still, however, another race of insects, which are bred very probably from the spoils of the former, and produce after some time similar appearances; these dying, the water is then thought to change no more. However, it very often happens, especially in hot climates, that nothing can drive these nauseous insects from the ship's store of water. They often increase to a very disagreeable and frightful size, so as to deter the mariner, though parching with thirst, from tasting that cup which they have contaminated.

This water as thus described, therefore, is a very different fluid from that simple elementary substance upon which philosophical theories have been founded, and concerning the nature of which there have been so many disputes. Elementary water is no way compounded, but it is without taste, smell, or colour, and incapable of being discerned by any of the senses except the touch. This is the famous dissolvent of the chemists, into which, as they have boasted, they can reduce all bodies, and which makes up all other substances, only by putting on a different disguise. In some forms it is fluid, transparent, and evasive of the touch, in others hard, firm, and elastic. In some it is stiffened by cold, in others dissolved by fire. According to them it only assumes external shapes from accidental causes, but the mountain is as much a body of water as the cake of ice that melts on its brow; and even the philosopher himself is composed of the same materials with the cloud or meteor which he contemplates.

Speculation seldom rests when it begins. Others, disallowing the universality of this substance, will not allow that in a state of nature there is any such thing as water at all. "What assumes the appearance," say they, "is nothing more than melted ice. Ice is the real element of Nature's making, and when found in a state of fluidity it is then in a state of violence. All substances are naturally hard, but some more readily melt with heat than others. It requires a great heat to melt iron; a smaller heat will melt copper; silver, gold, tin, and lead melt with smaller still; ice, which is a body like the rest, melts with a very moderate warmth; and quicksilver melts with the smallest warmth of all. Water, therefore, is but ice kept in continual fusion, and still returning to its former state when the heat is taken away." Between these opposite opinions the controversy has been carried on with great ardour, and much has been written on both sides; and yet, when we come to examine the debate, it will probably terminate in this question, whether cold or heat first began their operations upon water. This is a fact of very little importance if known; and, what is more, it is a fact we can never know.

---

[1] Phil. Trans. vol. v. part ii. p. 71.

Indeed, if we examine into the operations of cold and heat upon water, we shall find that they produce somewhat similar effects. Water dilates in its bulk, by heat, to a very considerable degree; and, what is more extraordinary, it is likewise dilated by cold in the same manner.

If water be placed over a fire, it grows gradually larger in bulk, as it becomes hot, until it begins to boil; after which no art can either increase its bulk or its heat. By increasing the fire, indeed, it may be more quickly evaporated away; but its heat and its bulk still continue the same. By the expanding of this fluid, by heat, philosophers have found a way to determine the warmth or the coldness of other bodies; for if put into a glass tube, by its swelling and rising, it shows the quantity of heat in the body to which it is applied; and by its contracting and sinking, it shows the absence of the same. Instead of using water in this instrument, which is called a thermometer, they now make use of spirit of wine, which is not apt to freeze, and which is endued even with a greater expansion, by heat, than water.[1] The instrument consists of nothing more than a hollow ball of glass, with a long tube growing out of it. This being partly filled with spirits of wine tinctured red, so as to be seen when it rises, the ball is plunged into boiling water, which making the spirit within expand and rise in the tube, the water marks the greatest height to which it ascends; at this point the tube is to be broken off, and. then hermetically sealed, by melting the glass with a blowpipe: a scale being placed by the side, completes the thermometer. Now as the fluid expands or condenses with heat or cold, it will rise and fall in the tube in proportion; and the degree or quantity of ascent or descent will be seen in the scale.

No fire, as was said, can make water hotter, after it begins to boil. We can, therefore, at any time be sure of an equable certain heat; which is that of boiling water, which is invariably the same. The certainty of such a heat is not less useful than the instrument that measures it. It affords a standard, fixed degree of heat over the whole world; boiling water being as hot in Greenland as upon the coast of Guinea. One fire is more intense than another: of heat there are various degrees; but boiling water is a heat everywhere the same, and easily procurable.

As heat thus expands water, so cold, when it is violent enough to freeze the same, produces exactly the same effect, and expands it likewise. Thus water is acted upon in the same manner by two opposite qualities; being dilated by both. As a proof that it is dilated by cold, we have only to observe the ice floating on the surface of a pond, which it would not do were it not dilated, and grown more bulky, by freezing, than the water which remains unfrozen. Mr. Boyle, however, put the matter past a doubt, by a variety of experiments.[2] Having poured a proper quantity of water into a strong earthen vessel, he exposed it, uncovered, to the open air, in frosty nights: and observed, that continually the ice reached higher than the water before it was frozen. He filled also a tube with water, and stopped both ends with wax: the water, when frozen, was found to push out the stopples from both ends; and a rod of ice appeared at each end of the tube, which showed how much it was swollen by the cold within.

From hence therefore, we may be very certain of the cold dilating the water; and experience also shows, that the force of this expansion has been found as great as any which heat has been found to produce. The touch-hole of a strong gun barrel being stopped, and a plug of iron forcibly driven into the muzzle, after the barrel had been filled with water, it was placed in a mixture of ice and salt; the plug, though soldered to the barrel, at first gave way, but being fixed in more firmly, within a quarter of an hour the gun-barrel burst with a loud noise, and blew up the cover of the box wherein it lay. Such is its force in an ordinary experiment. But it has been known to burst cannons, filled with water, and then left to freeze; for the cold congealing the water, and the ice swelling, it became irresistible. The bursting of rocks by frost, which is frequent in the northern climates, and is sometimes seen in our own, is an equal proof of the expansion of congealed water. For having by some means insinuated itself into the body of the rock, it has remained there, till the cold was sufficient to effect it by congelation. But when once frozen, no obstacle is able to confine it from dilating; and, if it cannot otherwise find room, the rock must burst asunder.

This alteration in the bulk of water might have served as a proof that it was capable of being compressed into a narrower space than it occupied before; but, till of late, water was held to be incompressible. The general opinion was, that no art whatsoever could squeeze it into a narrow compass; that no power on earth, for instance, could force a pint of water into a vessel that held an hair's-breadth less than a pint. And this, said they, appears from the famous Florentine experiment; where the water, rather than suffer a compressure, was seen to ooze through the pores of the solid metal; and, at length, making a cleft in the side, spun out with great vehemence. But later trials have proved that water is very compressible, and partakes of that elasticity which every other body possesses in some degree. Indeed, had not mankind been dazzled by the brilliancy of one inconclusive experiment, there were numerous reasons to convince them of its having the same properties with other substances. Ice, which is water in another state, is very elastic. A stone, flung slantingly along the surface of a pond, bounds from the water several times; which shows it to be elastic also. But the trials of Mr. Canton have put this past all doubt: which being somewhat similar to those of the great Boyle, who pressed it with weights properly applied, carry sufficient conviction.

---

[1] As mercury expands by heat and contracts by cold with greater uniformity than spirit of wine, it has come to supersede the use of the latter in thermometers.

[2] Boyle, vol. i. p. 610.

What has been hitherto related, is chiefly applicable to the element of water alone; but its fluidity is a property that it possesses in common with several other substances, in other respects greatly differing from it. That quality which gives rise to the definition of the fluid, namely, that its parts are in a continual intestine motion, seems extremely applicable to water. What the shapes of those parts are, it would be vain to attempt to discover. Every trial only shows the futility of the attempt; all we find is, that they are extremely minute; and that they roll over each other with the greatest ease. Some, indeed, from this property alone, have not hesitated to pronounce them globular; and we have, in all our hydrostatic books, pictures of these little globes in a state of sliding and rolling over each other. But all this is merely the work of imagination; we know that substances of any kind, reduced very small, assume a fluid appearance, somewhat resembling that of water. Mr. Boyle, after finely powdering and sifting a little dry powder of plaster of Paris, put it in a vessel over the fire, where it soon began to boil like water, exhibiting all the motions and appearances of a boiling liquor. Although but a powder, the parts of which we know are very different from each other, and just as accident has formed them, yet it heaved in great waves like water. Upon agitation, a heavy body will sink to the bottom, and a light one emerge to the top. There is no reason, then, to suppose the figure of the parts of water round, since we see their fluidity very well imitated by a composition, the parts of which are of various forms and sizes. The shape of the parts of the water, therefore, we must be content to continue ignorant of. All we know is, that earth, air, and fire, conduce to separate the parts from each other.

Earthy substances divide the parts from each other, and keep them asunder. This division may be so great, that the water will entirely lose its fluidity thereby. Mud, potters' clay, and dried bricks, are but so many different combinations of earth and water; each substance in which the parts of water are most separated from each other, appearing to be the most dry. In some substances, indeed, where the parts of water are greatly divided, as in porcelain, for instance, it is no easy matter to recover and bring them together again; but they continue in a manner fixed and united to the manufactured clay. This circumstance led Dr. Cheney into a very peculiar train of thinking. He suspected that the quantity of water on the surface of the earth was daily decreasing. For, says he, some parts of it are continually joined to vegetable, animal, and mineral substances, which no art can again recover. United with these, the water loses its fluidity; for if, continues he, we separate a few particles of any fluid, and fasten them to a solid body, or keep them asunder, they will be fluid no longer. To produce fluidity, a considerable number of such particles are required; but here they are close and destitute of their natural properties. Thus, according to him, the world is growing every day harder and harder, and the earth firmer and firmer; and there may come a time when every object around us may be stiffened in universal frigidity! However, we have causes enough of anxiety in this world already, not to add this preposterous concern to the number.

That air also contributes to divide the parts of water, we can have no manner of doubt; some have even disputed whether water be not capable of being turned into air. However, though this cannot be allowed, it must be granted, that it may be turned into a substance which greatly resembles air (as we have seen in the experiment of the æolipile) with all its properties; except that, by cold, this new made air may be condensed again into water.

But of all the substances which tend to

divide the parts of water, fire is the most powerful. Water, when heated into steam, acquires such force, and the parts of it tend to fly off from each other with such violence, that no earthly substance we know of is strong enough to confine them. A single drop of water, converted into steam, has been found capable of raising a weight of twenty tons; and would have raised twenty thousand, were the vessel confining it sufficiently strong, and the fire below increased in proportion.

From this easy yielding of its parts to external pressure, arises the art of determining the specific gravity of bodies by plunging them in water; with many other useful discoveries in that part of natural philosophy, called *hydrostatics*. The laws of this science, which Archimedes began, and Pascal, with some other of the moderns, have much improved, rather belong to experimental than to natural history. However, I will take leave to mention some of the most striking paradoxes in this branch of science, which are as well confirmed by experiment, as rendered universal by theory. It would, indeed, be unpardonable, while discoursing on the properties of water, to omit giving some account of the manner in which it sustains such immense bulks, as we see floating upon its soft and yielding surface; how some bodies, that are known to sink at one time, swim with ease, if their surface be enlarged; how the heaviest body, even gold itself, may be made to swim upon water; and how the lightest, such as cork, shall remain sunk at the bottom; how the pouring in of a single quart of water, will burst a hogshead hooped with iron; and how it ascends, in pipes, from the valley to travel over the mountain; these are circumstances that are at first surprising; but, upon a slight consideration, lose their wonder.

[1]In order to conceive the manner in which all these wonders are effected, we must begin by observing that water is possessed of an invariable property, which has not hitherto been mentioned, that of always keeping its surface level and even. Winds, indeed, may raise it into waves, or art spurt it up in fountains; but ever, when left to itself, it sinks into a smooth even surface, of which no one part is higher than another. If I should pour water, for instance, into the arm of a pipe of the shape of the letter U, the fluid would rise in the other arm just to the same height; because, otherwise, it would not find its level, which it invariably maintains. A pipe bending from one hill down into the valley, and rising by another, may be considered as a tube of this kind, in which the water, sinking in one arm, rises to maintain its level in the other. Upon this principle all water-pipes depend; which can never raise the water higher than the fountain from which they proceed.

Again, let us suppose for a moment, that the arms of the pipe already mentioned, may be made long or short at pleasure; and let us still further suppose, that there is some obstacle at the bottom of it which prevents the water pouring into one arm, from rising in the other. Now it is evident, that this obstacle at the bottom will sustain a pressure from the water in one arm, equal to what would make it rise in the other; and this pressure will be great, in proportion as the arm filled with water is tall. We may, therefore, generally conclude, that the bottom of every vessel is pressed by a force, in proportion to the height of the water in that vessel. For instance, if the vessel filled with water be forty feet high, the bottom of that vessel will sustain such a pressure as would raise the same water forty feet high, which is very great. From hence we see how extremely apt our pipes, that convey water to the city, are to burst; for descending from a hill of more than forty feet high, they are pressed by the water contained in them, with a force equal to what would raise it to more than forty feet high; and that this is sometimes able to burst a wooden pipe, we can have no room to doubt of.

Still recurring to our pipe, let us suppose one of its arms ten times as thick as the other: this will produce no effect whatsoever upon the obstacle below, which we supposed hindering its rise in the other arm; because, how thick soever the pipe may be, its contents would only rise to its own level; and it will, therefore, press the obstacle with a force equal thereto. We may, therefore, universally conclude, that the bottom of any vessel is pressed by its water, not as it is broad or narrow, but in proportion as it is high. Thus the water contained in a vessel not thicker than my finger, presses its bottom as forcibly as the water contained in a hogshead of an equal height; and, if we made holes in the bottoms of both, the water would burst out as forceful from the one as the other. Hence we may, with great ease, burst a hogshead with a single quart of water; and it has been often done. We have only,[2] for this, to place a hogshead on one end, filled with water; we then bore a hole in its top, into which we plant a narrow tin pipe, of about thirty feet high; by pouring a quart of water into this, at the top, as it continues to rise higher in the pipe, it will press more forcibly on the bottom and sides of the hogshead below, and at last burst it.

---

[1] In the above sketch, the manner of demonstrating used by Monsieur D'Alembert is made use of, as the most obvious, and the most satisfactory. Vide Essai sur, &c.

[2] Nollet's Lectures.

Still returning to our simple instrument of demonstration. If we suppose the obstacle at the bottom of the pipe to be moveable, so as that the force of the water can push it up into the other arm; such a body as quicksilver, for instance. Now, it is evident, that the weight of water weighing down upon this quicksilver in one arm, will at last press it up in the other arm; and will continue to press it upwards, until the fluid in both arms be upon a par. So that here we actually see quicksilver, the heaviest substance in the world, except gold and platina, floating upon water, which is but a very light substance.

When we see water thus capable of sustaining quicksilver, we need not be surprised that it is capable of floating much lighter substances, ships, animals, or timber. When anything floats upon water, we always see that a part of it sinks in the same. A cork, a ship, a buoy, each buries itself in a bed on the surface of the water; this bed may be considered as so much water displaced; the water will, therefore, lose so much of its own weight, as is equal to the weight of that bed of water which it displaces. If the body be heavier than a similar bulk of water, it will sink; if lighter, it will swim. Universally, therefore, a body plunged in water, loses as much of its weight as is equal to the weight of a body of water of its own bulk. Some light bodies, therefore, such as cork, lose much of their weight, and therefore swim; other more ponderous bodies sink, because they are heavier than their bulk of water.

Upon this simple theorem entirely depends the art of weighing metals hydrostatically. I have a guinea, for instance, and desire to know whether it be pure gold; I have weighed it in the usual way with another guinea, and find it exactly of the same weight, but still I have some suspicion, from its greater bulk, that it is not pure. In order to determine this, I have nothing more to do than to weigh it in water with that same guinea that I know to be good, and of the same weight; and this will instantly show the difference; for the true ponderous metal will sink, and the false bulky one will be sustained in proportion to the greatness of its surface. Those whose business it is to examine the purity of metals, have a balance made for this purpose, by which they can precisely determine which is most ponderous, or, as it is expressed, which has the greatest specific gravity. Seventy-one pounds and a half of quicksilver, is found to be equal in bulk to a hundred pounds weight of gold. In the same proportion sixty of lead, fifty-four of silver, forty-seven of copper, forty-five of brass, forty-two of iron, and thirty-nine of tin, are each equal to a hundred pound of the same most ponderous of all metals.

This method of precisely determining the purity of gold, by weighing in water, was first discovered by Archimedes, to whom mankind have been indebted for many useful discoveries. Hiero, king of Sicily, having sent a certain quantity of gold to be made into a crown, the workman, it seems, kept a part for his own use, and supplied the deficiency with a baser metal. His fraud was suspected by the king, but could not be detected till he applied to Archimedes, who weighed the crown in water; and by this method, informed the king of the quantity of gold which was taken away.

It has been said, that all fluids endeavour to preserve their level; and, likewise, that a body pressing on the surface, tended to destroy that level. From hence, therefore, it will easily be inferred, that the deeper any body sinks, the greater will be the resistance of the depressed fluid beneath. It will be asked, therefore, as the resistance increases in proportion as the body descends, how comes the body, after it has got a certain way, to sink at all? The answer is obvious: From the fluid above pressing it down with almost as great a force as the fluid beneath presses it up. Take away, by any art, the pressure of the fluid from above, and let only the resistance of the fluid from below be suffered to act, and after the body is gone down very deep, the resistance will be insuperable. To give an instance: A small hole opens in the bottom of a ship at sea, forty feet, we will suppose, below the surface of the water; through this the water bursts up with great violence; I attempt to stop it with my hand, but it pushes the hand violently away. Here the hand is, in fact, a body attempting to sink upon water, at a depth of forty feet, with the pressure from above taken away. The water, therefore, will overcome my strength; and will continue to burst in till it has got to its level: if I should then dive into the hold, and clap my hand upon the opening, as before, I should perceive no force acting against my hand at all; for the water above presses the hand as much down against the hole, as the water without presses it upward. For this reason, also, when we dive to the bottom of the water, we sustain a very great pressure from above, it is true, but it is counteracted by the pressure from below; and the whole acting uniformly on the surface of the body, wraps us close round without injury.

As I have deviated thus far, I will just mention one or two properties more, which water, and all such like fluids, is found to possess. And, first, their ascending in vessels which are emptied of air, as in our common pumps for instance. The air, however, being the agent in this case, we must previously examine its properties, before we undertake the explanation. The other property to be mentioned is, that of their ascending in small capillary tubes. This is one of the most extraordinary and inscrutable appearances in nature. Glass tubes may be drawn, by means of a lamp, as fine as a hair; still preserving their hollow within. If one of these be planted in a vessel of water, or spirit of wine, the liquor will immediately be seen to ascend; and it will rise higher, in proportion as the tube is smaller; a foot, two feet and more. How does this come to pass? Is the air the cause? No: the liquor rises, although the air be taken away. Is attraction the cause? No: for quicksilver does not ascend, which it otherwise would. Many have been the theories of experimental philosophers to explain this property. Such as are fond of travelling in the regions of conjecture, may consult Hawksbee, Morgan, Jurin, or Watson, who have examined the subject with great minuteness. Hitherto, however, nothing but doubts, instead of knowledge, have been the result of their inquiries. It will not, therefore, become us to enter into the minuteness of the inquiry, when we have so many greater wonders to call our attention away.[1]

CHAP. XIV.

OF THE ORIGIN OF RIVERS.

"The sun ariseth, and the sun goeth down, and pants for the place from whence he arose. All things are filled with labour, and man cannot utter it. All the rivers run into the sea, yet the sea is not full. Unto the place whence the rivers come, thither they return again. The eye is not satisfied with seeing, nor the ear with hearing."[2] Thus speaks the wisest of the Jews. And at so early a period was the curiosity of man employed in observing these great circulations of nature. Every eye attempted to explain those appearances; and every philosopher who has long thought upon the subject, seems to give a peculiar solution. The inquiry whence rivers are produced; whence they derive those unceasing stores of water, which continually enrich the world with fertility and verdure; has been variously considered, and divided the opinions of mankind more than any other topic in natural history.

In this contest the various champions may be classed under two leaders; Mr De la Hire, who contends that rivers must be supplied from the sea, strained through the pores of the earth; and Dr Halley, who has endeavoured to demonstrate that the clouds alone are sufficient for the supply. Both sides have brought in mathematics to their aid; and have shown that long and laborious calculations can at any time be made to obscure both sides of a question.

De la Hire[3] begins his proofs, that rain-water, evaporated from the sea, is insufficient for the production of rivers: by showing that rain never penetrates the surface of the earth above sixteen inches. From thence he infers, that it is impossible for it in many cases, to sink so as to be found at such considerable depths below. Rain-water, he grants, is often seen to mix with rivers, and to swell their currents; but a much greater part of it evaporates. "In fact," continues he, "if we suppose the earth every where covered with water, evaporation alone would be sufficient to carry off two feet nine inches of it in a year: and yet we very well know, that scarcely nineteen inches of rain-water falls in that time: so that evaporation would carry off a much greater quantity than is ever known to descend. The small quantity of rain-water that falls is, therefore, but barely sufficient for the purposes of vegetation. Two leaves of a fig-tree have been found, by experiment, to imbibe from the earth, in five hours and a half, two ounces of water. This implies the great quantity of fluid that must be exhausted in the maintenance of one single plant. Add to this, that the waters of the river Rungis will, by calculation, rise to fifty inches; and the whole country from whence they are supplied never receives fifty inches in the year by rain. Besides this, there are many salt springs which are known to proceed immediately from the sea, and are subject to its flux and reflux. In short, wherever we dig beneath the surface of the earth, except in a very few instances, water is to be found; and it is by this subterraneous water that springs and rivers, nay, a great part of vegetation itself, is supported. It is this subterraneous water which is raised into steam, by the internal heat of the earth, that feeds plants. It is this subterraneous water that distils through interstices; and there, cooling, forms fountains. It is this that, by the addition of rains, is increased into rivers, and pours plenty over the whole earth."

---

[1] This phenomenon is soluble upon the principle, that the attraction between the particles of glass and water is greater than the attraction between the particles of water themselves; for, if a glass tube be held parallel to the horizon, and a drop of water be applied to the under side of the tube, it will adhere to it: nor will it fall from the glass, till its bulk and gravity are so far increased as to overbalance the attraction of the glass. Hence it is easy to conceive, how sensibly such a power must act on the surface of a fluid not viscid, as water, contained within the cavity of a small glass tube; as also that the quantity of the fluid raised will be as the surface of the bore which it fills, that is, as the diameter of the tube.

[2] Ecclesiastes, chap. i. ver. 5, 7, 8.

[3] Hist. de l' Acad. 1713, p. 56

On the other side of the question,[1] it is asserted, that the vapours which are exhaled from the sea, and driven by the winds upon land, are more than sufficient to supply not only plants with moisture, but also to furnish a sufficiency of water to the greatest rivers. For this purpose, an estimate has been made of the quantity of water emptied at the mouths of the greatest rivers; and of the quantity also raised from the sea by evaporation; and it has been found, that the latter by far exceeds the former. This calculation was made by Mr Marriotte. By him it was found, upon receiving such rain as fell in a year, in the proper vessel fitted for that purpose; that one year with another, there might fall about twenty inches of water upon the surface of the earth, throughout Europe. It was also computed that the river Seine, from its source to the city of Paris, might cover an extent of ground, that would supply it annually with above seven millions of cubic feet of this water, formed by evaporation. But upon computing the quantity which passed through the arches of one of its bridges in a year, it was found to amount only to two hundred and eighty millions of cubic feet, which is not above the sixth part of the former number. Hence it appears, that this river may receive a supply, brought to it by the evaporated waters of the sea, by its current; and, therefore, evaporation is more than sufficient for maintaining the greatest rivers, and supplying the purposes also of vegetation.

In this manner, the sea supplies sufficient humidity to the air, for furnishing the earth with all necessary moisture. One part of its vapours falls upon its own bosom, before it arrives upon land. Another part is arrested by the sides of mountains, and is compelled, by the rising stream of air, to mount upward towards the summits. Here it is presently precipitated, dripping down by the crannies of the stone. In some places, entering into the caverns of the mountain, it gathers in those receptacles, which being once filled, all the rest overflows; and breaking out by the sides of the hills, forms single springs. Many of these run down by the valleys or guts between the ridges of the mountain, and, coming to unite, form little rivulets or brooks; many of these meeting in one common valley, and gaining the plain ground, being grown less rapid, become a river; and many of these uniting, make such vast bodies of water as the Rhine, the Rhone, and the Danube.

There is still a third part which falls upon the lower grounds, and furnishes plants with their wonted supply. But the circulation does not rest even here; for it is again exhaled into vapour by the action of the sun; and afterwards returned to that great mass of waters whence it first arose. "This," adds Dr Halley, "seems the most reasonable hypothesis; and much more likely to be true, than that of those who derive all springs from the filtering of the sea-waters, through certain imaginary tubes or passages within the earth; since it is well known that the greatest rivers have their most copious fountains the most remote from the sea."

This seems the most general opinion; and yet, after all, it is still pressed with great difficulties; and there is still room to look out for a better theory. The perpetuity of many springs, which always yield the same quantity, when the least rain or vapour is afforded, as well as when the greatest, is a strong objection. Derham[2] mentions a spring at Upminster, which he could never perceive by his eye to be diminished, in the greatest droughts, even when all the ponds in the country, as well as an adjoining brook, have been dry for several months together. In the rainy seasons, also, it was never overflowed; except sometimes, perhaps, for an hour or so, upon the emission of the external rains. He, therefore, justly enough concludes, that had this spring its origin from rain or vapour, there would be found an increase or decrease of its water, corresponding to the causes of its production.

Thus the reader, after having been tossed from one hypothesis to another, must at last be content to settle in conscious ignorance. All that has been written upon this subject, affords him rather something to say, than something to think; something rather for others than for himself. Varenius, indeed, although he is at a loss for the origin of rivers, is by no means so as to their formation. He is pretty positive that all rivers are artificial. He boldly asserts that their channels have been originally formed by the industry of man. His reasons are, that when a new spring breaks forth, the water does not make itself a new channel, but spreads over the adjacent land. "Thus," says he, "men are obliged to direct its course; or, otherwise, Nature would never have found one." He enumerates many rivers that are certainly known, from history, to have been dug by men. He alleges, that no salt-water rivers are found, because men did not want salt-water; and as for salt, that was procurable at less expense than digging a river for it. However, it costs a speculative man but a small expense of thinking to form such an hypothesis. It may perhaps engross the reader's patience to detain him longer upon it.

---

[1] Phil. Trans. vol. ii. p. 128.

[2] Durham Physico-Theol.

Nevertheless, though Philosophy be thus ignorant as to the production of rivers, yet the laws of their motion, and the nature of their currents, have been very well explained. The Italians have particularly distinguished themselves in this respect; and it is chiefly to them that we are indebted for the improvement.[1]

All rivers have their source either in mountains, or elevated lakes; and it is in their descent from those that they acquire that velocity which maintains their future current. At first their course is generally rapid and headlong; but it is retarded in its journey, by the continual friction against its banks, by the many obstacles it meets to divert its stream, and by the plains generally becoming more level as it approaches towards the sea.

If this acquired velocity be quite spent, and the plain through which the river passes is entirely level; it will, notwithstanding, still continue to run from the perpendicular pressure of the water, which is always in exact proportion to the depth. This perpendicular pressure is nothing more than the weight of the upper waters pressing the lower out of their places; and consequently driving them forward as they cannot recede against the stream. As this pressure is greatest in the deepest parts of the river, so we generally find the middle of the stream most rapid; both because it has the greatest motion thus communicated by the pressure and the fewest obstructions from the banks on either side.

Rivers thus set into motion are almost always found to make their own beds. Where they find the bed elevated, they wear its substance away, and deposit the sediment in the next hollow, so as in time to make the bottom of their channels even. On the other hand, the water is continually gnawing and eating away the banks on each side; and this with more force as the current happens to strike more directly against them. By these means it always has a tendency to render them more straight and parallel to its own course. Thus it continues to rectify its banks and enlarge its bed; and, consequently, to diminish the force of its stream, till there becomes an equilibrium between the force of the water, and the resistance of its banks, upon which both will remain without any farther mutation. And it is happy for man that bounds are thus put to the erosion of the earth by water; and that we find all rivers only dig and widen themselves but to a certain degree."[2]

In those plains[3] and large valleys where great rivers flow, the bed of the river is usually lower than any part of the valley. But it often happens, that the surface of the water is higher than many of the grounds that are adjacent to the banks of the stream. If, after inundations, we take a view of some rivers, we shall find their banks appear above water at a time that all the adjacent valley is overflowed. This proceeds from the frequent deposition of mud, and such like substances, upon the banks, by the rivers frequently overflowing; and thus, by degrees, they become elevated above the plain; and the water is often seen higher also.

Rivers, as every body has seen, are always broadest at the mouth, and grow narrower towards their source. But what is less known, and probably more deserving curiosity, is, that they run in a more direct channel as they immediately leave their sources; and that their sinuosities and turnings become more numerous as they proceed. It is a certain sign among the savages of North America, that they are near the sea, when they find the rivers winding, and every now and then changing their direction. And this is even now become an indication to the Europeans themselves, in their journeys through those trackless forests. As those sinuosities, therefore, increase as the river approaches the sea, it is not to be wondered at that they sometimes divide, and thus disembogue by different channels. The Danube disembogues into the Euxine by seven mouths; the Nile by the same number; and the Wolga by seventy.

The currents[4] of rivers are to be estimated very differently from the manner in which those writers, who have given us mathematical theories on this subject, represent them. They found their calculations upon the surface being a perfect plain from one bank to the other: but this is not the actual state of nature: for rivers in general rise in the middle; and this convexity is greatest in proportion as the rapidity of the stream is greater. Any person, to be convinced of this, need only lay

---

8. Guglielmini della Natura de Fiumi, passim.

[2] Guglielmini della Natura de Fiumi, passim.

[3] Buffon de Fleuves, passim, vol. ii.

[4] Ibid.

his eye, as nearly as he can, on a level with the stream, and looking across to the opposite bank, he will perceive the river in the midst to be elevated considerably above what it is at the edges. This rising, in some rivers, is often found to be three feet high; and is ever increased in proportion to the rapidity of the stream. In this case, the water in the midst of the current loses a part of its weight, from the velocity of its motion; while that at the sides, for the contrary reason, sinks lower. It sometimes however happens, that this appearance is reversed; for when tides are found to flow up with violence against the natural current of the water, the greatest rapidity is then found at the sides of the river, as the water there least resists the influx from the sea. On those occasions, therefore, the river presents a concave rather than a convex surface; and as in the former case, the middle waters rose in a ridge, in this case they sink in a furrow.

The stream of all rivers is more rapid in proportion as its channel is diminished. For instance, it will be much swifter where it is ten yards broad, than where it is twenty; for the force behind still pushing the water forward, when it comes to the narrow part, it must make up by velocity what it wants in room.

It often happens that the stream of a river is opposed by one of its jutting banks, by an island in the midst, the arches of a bridge, or some such obstacle. This produces not unfrequently a back current; and the water having passed the arch with great velocity, pushes the water on each side of its direct current. This produces a side current, tending to the bank; and not unfrequently a whirlpool; in which a large body of waters are circulated in a kind of cavity, sinking down in the middle. The central point of the whirlpool is always lowest, because it has the least motion: the other parts are supported, in some measure, by the violence of theirs, and consequently rise higher as their motion is greater; so that towards the extremity of the whirlpool, must be higher than towards the centre.

If the stream of a river be stopped at the surface, and yet be free below; for instance, if it be laid over by a bridge of boats, there will then be a double current; the water at the surface will flow back, while that at the bottom will proceed with increased velocity. It often happens that the current at the bottom is swifter than at the top, when, upon violent land-floods, the weight of waters towards the source presses the waters at the bottom, before it has had time to communicate its motion to the surface. However, in all other cases, the surface of the stream is swifter than the bottom, as it is not retarded by rubbing over the bed of the river.

It might be supposed that bridges, dams, and other obstacles in the current of a river would retard its velocity. But the difference they make is very inconsiderable. The water, by these stoppages, gets an elevation above the object; which, when it has surmounted, it gives a velocity that recompenses the former delay. Islands and turnings also retard the course of the stream but very inconsiderably; any cause which diminishes the quantity of the water, most sensibly diminishes the force and the velocity of the stream.

An increase[1] of water in the bed of the river always increases its rapidity; except in cases of inundation. The instant the river has overflowed its banks, the velocity of its current is always turned that way, and the inundation is perceived to continue for some days; which it would not otherwise do, if, as soon as the cause was discontinued, it acquired its former rapidity.

A violent storm, that sets directly up against the course of the stream, will always retard, and sometimes entirely stop its course. I have seen an instance of this, when the bed of a large river was entirely dry for some hours, and fish were caught among the stones at the bottom.

Inundations are generally greater towards the source of rivers than farther down; because the current is generally swifter below than above; and that for the reasons already assigned.

A little river[2] may be received into a large one, without augmenting either its width or depth. This, which at first view seems a paradox, is yet very easily accounted for. The little river, in this case, only goes towards increasing the swiftness of the larger, and putting its dormant waters into motion. In this manner the Venetian branch of the Po, was pushed on by the Ferrarese branch and that of Panaro, without any enlargement of its breadth or depth from these accessions.

A river tending to enter another, either perpendicularly, or in an opposite direction, will be diverted by degrees from that direction; and be obliged to make itself a more favourable entrance downward, and more conspiring with the stream of the former.

The union of two rivers into one, makes it flow the swifter; since the same quantity of water, instead of rubbing against four shores, now only rubs against two. And, besides, the current being deeper, becomes, of consequence, more fitted for motion.

With respect to the places from whence rivers proceed, it may be taken for a general rule, that the largest[3] and highest mountains supply the greatest and most extensive rivers. It may also be remarked, in whatever direction the ridge of the mountain runs, the river takes an opposite course. If the mountain, for instance, stretches from north to south, the river runs from east to west; and so contrariwise. These are some of the most generally received opinions with regard to the course of rivers; however, they are liable to many exceptions; and nothing but an actual knowledge of each particular river can furnish us with an exact theory of its current.

---

[1] Buffon, vol. ii. p. 62.

[2] Guglielmini.

[3] Dr Halley.

The largest rivers of Europe are, first, the Wolga, which is about six hundred and fifty leagues in length, extending from Reschow to Astrachan. It is remarkable of this river, that it abounds with water during the summer months of May and June; but all the rest of the year is so shallow as scarce to cover its bottom, or allow a passage for loaded vessels that trade up its stream. It was up this river that the English attempted to trade into Persia, in which they were so unhappily disappointed, in the year 1741. The next in order is the Danube. The course of this is about four hundred and fifty leagues, from the mountains of Switzerland to the Black Sea. It is so deep between Buda and Belgrade, that the Turks and Christians have fleets of men-of-war upon it; which frequently engaged during the last war between the Ottomans and the Austrians: however it is unnavigable further down, by reason of its cataracts, which prevent its commerce into the Black Sea. The Don, or Tanais, which is four hundred leagues from the source of that branch of it called the *Sofina*, to its mouth in the Euxine Sea. In one part of its course, it approaches near the Wolga; and Peter the Great had actually begun a canal, by which he intended joining those two rivers; but this he did not live to finish. The Nieper, or Boristhenes, which rises in the middle of Muscovy, and runs a course of three hundred and fifty leagues, to empty itself into the Black Sea. The Old Cossacks inhabit the banks and islands of this river; and frequently cross the Black Sea, to plunder the maritime places on the coasts of Turkey. The Dwina, which takes its rise in a province of the same name in Russia, that runs a course of three hundred leagues, and disembogues into the White Sea, a little below Archangel.

The largest rivers in Asia are, the Hohanho, in China, which is eight hundred and fifty leagues in length, computing from its source at Raja Ribron, to its mouth in the gulf of Changi. The Jenisca of Tartary, about eight hundred leagues in length, from the lake Selinga, to the Icy Sea. This river is, by some, supposed to supply most of that great quantity of drift wood which is seen floating in the seas near the Arctic circle. The Oby, of five hundred leagues, running from the lake of Kila into the Northern Sea. The Amour, in Eastern Tartary, whose course is about five hundred and seventy-five leagues, from its source to its entrance into the sea of Kamtschatka. The Kiam, in China, five hundred and fifty leagues in length. The Ganges, one of the most noted rivers in the world, and about as long as the former.[1] It

---

[1] The Ganges and the Burrampooter descend, from the highest mountains in the world, (the mountains of Thibet,) into a gulf which runs 225 miles into the continent. The Burrampooter is somewhat the larger river of the two, but it first takes the name of the Megna, when joined by a smaller stream so called, and afterwards loses this second name on its union with the Ganges, at the distance of about forty miles from the sea. The area of the delta of the Ganges (without including that of the Burrampooter, which has now become conterminous) is considerably more than double that of the Nile; and its head commences at a distance of 220 miles, in a direct line from the sea. Its base is two hundred miles in length, including the space occupied by the two great arms of the Ganges which bound it on either side. That part of the delta which borders on the sea is composed of a labyrinth of rivers and creeks, all filled with salt water, except those immediately communicating with the principal arm of the Ganges. This tract alone, known by the name of the Woods, or Sunderbunds, a wilderness infested by tigers and alligators. is, according to Rennell, equal in extent to the whole principality of Wales.

On the sea-coast there are eight great openings, each of which has evidently, at some ancient period, served in its turn as the principal channel of discharge. Although the flux and reflux of the tide extend even to the head of the delta, when the river is low, yet, when it is periodically swollen by tropical rains, the velocity of the stream counteracts the tidal current, so that, except very near the sea, the ebb and flow become insensible. During the flood season, therefore, the Ganges almost assumes the character of a river entering a lake or inland sea; the movements of the ocean being then subordinate to the force of the river, and only slightly disturbing its operations. The great gain of the delta in height and area takes place during the inundations; and during other seasons of the year, the ocean makes reprisals, scouring out the channels, and sometimes devouring rich alluvial plains.

So great is the quantity of mud and sand poured by the Ganges into the gulf in the flood season, that the sea only recovers its transparency at the distance of sixty miles from the coast. The general slope, therefore, of the new strata must be extremely gradual. By the charts recently published, it appears that there is a gradual deepening from four to about sixty fathoms, as we proceed from the base of the delta to the distance of about one hundred miles into the Bay of Bengal. At some few points seventy, or even one hundred fathoms, are obtained at that distance.

One remarkable exception, however, occurs to the regularity of the shape of the bottom; for, opposite the middle of the delta, at the distance of thirty or forty miles from the coast, is a nearly circular space called the "swatch of no ground," about fifteen miles in diameter, where soundings of 100, and even 130 fathoms, fail to reach the bottom. This phenomenon is the more extraordinary, since the depression occurs within five miles of the line of shoals; and not only do the waters charged with Gangetic sediment pass over it continually, rises in the mountains which separate India from Tartary; and running through the dominions of the Great Mogul, discharges itself by several mouths into the bay of Bengal. It is not only esteemed by the Indians for the depth and pureness of its stream, but for a supposed sanctity which they believe to be in its waters. It is visited annually by several hundred thousand pilgrims, who pay their devotions to the river as to a god: for savage simplicity is always known to mistake the blessings of the Deity, for the Deity himself. They carry their dying friends from distant countries, to expire on its banks; and to be buried in its stream. The water is lowest in April or May; but the rains beginning to fall soon after, the flat country is overflowed for several miles, till about the end of September; the waters then begin to retire, leaving a prolific sediment behind, that enriches the soil, and, in a few days' time, gives a luxuriance to vegetation, beyond what can be conceived by a European. Next to this may be reckoned the still more celebrated river Euphrates. This rises from two sources, northward of the city Erzerum, in Turcomania, and unites about three days' journey below the same; from whence, after performing a course of five hundred leagues, it falls into the gulf of Persia, fifty miles below the city of Bassora in Arabia. The river Indus is extended, from its source to its discharge into the Arabian Sea, four hundred leagues.

The largest rivers of Africa are, the Senegal, which runs a course of not less than eleven hundred leagues, comprehending the Niger, which some have supposed to fall into it. However, later accounts seem to affirm that the Niger is lost in the sands, about three hundred miles up from the western coasts of Africa.[1] Be this as it may, the Senegal is well known to be navigable for more than three hundred leagues up the country; and how much higher it may reach is not yet discovered, as the dreadful fatality of the inland parts of Africa, not only deters curiosity, but even avarice, which is a much stronger passion. At the end of last war, of fifty Englishmen that were sent to the factory at Galam, a place taken from the French, and nine hundred miles up the river, only one returned to tell the fate of his companions, who were destroyed by the climate. The celebrated river Nile is said to be nine hundred and seventy leagues, from its source among the Mountains of the Moon, in Upper Æthiopia, to its opening into the Mediterranean Sea. The sources of this river were considered as inscrutable by the ancients; and the causes of its periodical inundation were equally unknown.[2] They have both been ascertained

---

but, during the monsoons, the sea, loaded with mud and sand, is beaten back in that direction towards the delta. As the mud is known to extend for eighty miles farther into the gulf, we may be assured that, in the course of ages, the accumulation of strata in "the swatch" has been of enormous thickness; and we seem entitled to deduce, from the present depth at the spot, that the original inequalities of the bottom of the Bay of Bengal were on as grand a scale as are those of the main ocean.

[1] Notwithstanding the opinion of some writers, that the Niger of the moderns was known to Ptolemy, and even to Herodotus, it appears evident that nothing was known, by the ancients, of the central region of Africa, and that the streams referred to by those authors were in the more northern parts of that continent. Mungo Park reached the banks of the Niger, at Sego, in the kingdom of Bambarra (July 22, 1796,) and determined the direction of its course to be eastward, and not to the west, as had been commonly supposed. He traced its course upward to Bammakoo, and downward to Silla. On his second expedition (1805,) he embarked at Sansanding, with the intention of descending the river to its mouth; but, on reaching Boussa, was attacked by the natives, and killed. It was thus ascertained that the Niger rises in the western part of Africa 10°—12° N. lat.,) near the sources of the Senegal, and, after an easterly course of several hundred miles, runs in a southerly direction. Different opinions were entertained in regard to its termination. Some supposed it to flow into the Nile, others, into a great central lake: some maintained that it was lost in the sands; and others, that it emptied into the gulf of Guinea, or that the Congo, farther to the south, was its mouth. Numerous attempts were made, by the British government, to resolve the question, but with little success, until the expedition of 1821, under Denham and Clapperton. They discovered lake Tchad (lon. 15° E.) and, on visiting Soccatoo (6° 10′ E.,) found that the Niger there flowed to the south, under the name of the Quorra. Its termination, however, was yet undetermined. In 1825, Clapperton again set out on a tour of discovery, and crossed the Niger at Boussa. On this expedition, he was accompanied by his servant, Richard Lander, who, after the death of his master, attempted to descend the Niger from Furdah, but was prevented by the jealousy of the government. In 1830, Richard Lander set out from Badagry, with his brother John, for the purpose of following down the course of the river to its mouth. They reached the river at Boussa, from thence ascended to Youri and the Cubbie, which comes from Soccatoo. They then descended the river, which flows nearly south from Boussa, and which, after receiving the Shary, expands into a large lake, and thence empties, by several arms, into the Bight of Benin. The mouth by which they reached the sea, is laid down on the maps as the river Nun. Thus from Park's first point, in 1805, its course is traced for 2000 miles, a considerable part of which is navigable for steam-boats, through a rich and populous country, the inhabitants of which have made considerable progress in civilization. The river, in the upper part of its course, is known to the natives as the Joliba; in the lower, as the Quorra; the name *Niger* was erroneously applied to it by the Europeans, on the supposition that it was the river spoken of by Ptolemy.

[2] The sources of the Nile have never been accurately determined. Among the Greeks and Romans, this river excited the greatest interest; from its being the largest known to them, from its inundation, of which they had no other examples, and were ignorant of the cause, and from its unknown origin. The name *Nile*, according to Spineto (*Lectures on Hieroglyphics*,) is Greek; the Egyptians calling it merely *laro*, which means *river*. The true Nile is formed by the confluence

by the missionaries who have travelled into the interior parts of Æthiopia. The Nile takes its rise in the kingdom of Gojam,[1] from a small aperture on the top of a mountain, which, though not above a foot and a half over, yet was unfathomable. This fountain, when arrived at the foot of the mountain, expands into a river; and being joined by others, forms a lake thirty leagues long, and as many broad; from this, its channel, in some measure, winds back to the country where it first began: from thence, precipitating by frightful cataracts, it travels through a variety of desert regions, equally formidable, such as Ambara, Olaca, Damot, and Xaoa. Upon its arrival in the kingdom of Upper Egypt, it runs through a rocky channel, which some late travellers have mistaken for its cataracts. In the beginning of its course, it receives many lesser rivers into it; and Pliny was mistaken in saying that it received none. In the beginning also of its course it has many windings; but, for above three hundred leagues from the sea, it runs in a direct line. Its annual overflowings arise from a very obvious cause, which is almost universal with the great rivers that take their source near the line. The rainy season, which is periodical in those climates, floods the rivers; and as this always happens in our summer, so the Nile is at that time overflown. From these inundations, the inhabitants of Egypt derive happiness and plenty; and, when the river does not arise to its accustomed heights, they prepare for an indifferent harvest. It begins to overflow about the seventeenth of June; it generally continues to augment for forty days, and decreases in about as many more. The time of increase and decrease, however, is much more inconsiderable now than it was among the ancients. Herodotus informs us, that it was an hundred days rising, and as many falling; which shows that the inundation was much greater at that time than at present. Mr Buffon[1] has ascribed the present diminution, as well to the lessening of the Mountains of the Moon, by their substance having so long been washed down with the stream, as to the rising of the earth in Egypt, that has for so many ages received this extraneous supply. But we do not find, by the buildings that have remained since the times of the ancients, that the earth is much raised since then. Besides the Nile in Africa, we may reckon the Zara, and Coanza, from the greatness of whose openings into the sea, and the rapidity of whose streams, we form an estimate of the great distance from whence they come. Their courses, however, are spent in watering deserts and savage countries, whose poverty or fierceness have kept strangers away. .

---

[1] Kircher, Mund. Subt. vol. ii. p. 72.

of the *Bahr-el-Abiad* (white river) and the *Bahr el Azrek* (blue river,) in lat. 15° 40′ N. The former, rising in Abyssinia, to the south-west of lake Dembea, comes from the south-east, and was considered by Bruce as the Nile. The latter, however, which comes from the south-west, and is supposed to rise in the Mountains of the Moon, brings down the greatest mass of water, and is considered by Cailliaud as the true Nile. This is a mere dispute about words. In lat. 17° 40′, it receives the Tacazze from the east, enters Egypt in 24°, following nearly a northern course, and below Cairo (30° 15′ N.) divides into the two main arms above-mentioned, the Damietta, or the eastern, and the Rosetta, or western branch. The distance from the confluence of its two head branches to the sea is about 1500 miles; from its highest sources, probably not far from 2500 miles. The cataracts so much celebrated by the ancients, modern discoveries have shown to be insignificant; they appear to be hardly any thing more than what in America are called *rapids*. In Upper Egypt, it is confined between two ranges of mountains, which leave only a narrow strip on each side of the river. Near Cairo, the river valley widens, and the level nature of the country below allows it to spread itself over a wide plain. The seven mouths were called, by the ancients, the *Canopic*, the most western (probably to lake Edko or Mareotis,) the *Bolbitic* (the Rosetta branch,) the *Sebennitic* (probably terminating in lake Bourlos,) the *Phatnitic* or *Bucolic* (now the Damietta branch,) the *Tanitic*, the *Mendesian*, and the *Pelusiac* (the most easterly,) which entered the sea at different points of what is now lake Mewzaleh. In Upper and Middle Egypt, there are great numbers of canals on the left bank of the river, which serve to irrigate the country: the principal, called the *canal of Joseph*, communicates with lake Mœris. The inundations of the Nile are owing to periodical rains, which fall to the south of the seventeenth degree. They begin in March, but have no effect upon the river until three months later. Towards the end of June, it begins to rise, and continues rising at the rate of about four inches a day, until the end of September, when it falls for about the same period of time. Herodotus informs us that, in his time, a rise of sixteen cubits was sufficient to water the country: at present, twenty-two cubits are considered a good rise. A rise of twenty-six cubits, in 1829, destroyed a great many villages, with their inhabitants. The lower part of Egypt has, therefore, been very much raised since the time of Herodotus, by the accumulated deposits of rich slime brought down by the river. This mud, which is composed principally of argillaceous earth and carbonate of lime, serves to fertilize the overflowed lands, and is used for manure for such places as are not sufficiently saturated by the river: it is also formed into bricks, and various vessels for domestic use, &c. The present pacha has opened many of the old canals, which had been closed for centuries, and dug new ones: among the latter, the canal of Mahmood, connecting the harbour of Alexandria with the Nile, near Fouah, forty-eight miles long, ninety feet broad, and eighteen deep, is a magnificent work. Among the animals with which the Nile abounds, the most remarkable are the crocodile and the hippopotamus. In the ancient Egyptian mythology, the Nile was revered as the tutelary deity of the country. The Greeks make him the son of Pontus and Thalassa, or of Oceanus and Tethys. Memphis is said to have been his daughter. When the waters began to rise, the inhabitants celebrated the festivals called *Niloa*, sacrificed a black bull to him, strewed lotus flowers on the water, &c. In the city of Nilopolis, a temple was erected to him. His attributes are the crocodile, the sphinx, the hippopotamus, and the dolphin. The Nile has been personified in several statues, particularly in a very noble one of black marble, now in the Vatican. He is distinguished by his large cornucopia, by the sphinx couched under him, and by the sixteen little children playing around him. By the sixteen little children are understood the several risings of the river every year, as far as to sixteen cubits. The black marble is said to be in allusion to the Nile's coming from Ethiopia. The water flows down from under his robe, which conceals his urn, to denote that the head of the river was impenetrable. In some modern statues, the head of this figure is quite hidden under his robe for the same reason. An instrument, called a *Nilometer*, was constructed by the ancient Egyptians, consisting of a rod or pillar, marked with the necessary divisions, for the purpose of ascertaining the proportionate increases of the flood of the Nile. It is said by several Arabian writers to have been first set up by Joseph during his regency in Egypt. The measure of it was sixteen cubits.

But of all parts of the world, America, as it exhibits the most lofty mountains,[2] so also it supplies the largest rivers. The foremost of these is the great river Amazon, which, from its source in the lake of Lauricocha, to its discharge into the Western Ocean, performs a course of more than twelve hundred leagues.[3] The breadth and depth of this river are answerable to its vast length; and, where its width is most contracted, its depth is augmented in proportion. So great is the body of its waters, that other rivers, though before the objects of admiration, are lost in its bosom. It proceeds, after their junction, with its usual appearance, without any visible change in its breadth or rapidity; and, if we may so express it, remains great without ostentation. In some places it displays its whole magnificence, dividing into several large branches, and encompassing a multitude of islands; and, at length, discharging itself into the ocean, by a channel of a hundred and fifty miles broad. Another river, that may almost rival the former, is the St Lawrence, in Canada, which rising in the lake Assiniboils, passes from one lake to another, from Christinaux to Alempigo; from thence to lake Superior; thence to the lake Huron; to lake Erie; to lake Ontario; and, at last, after a course of nine hundred leagues, pours their collected waters into the Atlantic ocean. The river Mississippi is of more than seven hundred leagues in length, beginning at its source near the lake Assiniboils, and ending at its opening into the gulf of Mexico. The river Plate runs a length of more than eight hundred leagues from its source in the river Parana, to its mouth. The river Oroonoko is seven hundred and fifty leagues in length, from its source near Pasta, to its discharge into the Atlantic ocean.

Such is the amazing length of the greatest rivers; and even in some of these, the most remote sources very probably yet continue unknown. In fact, if we consider the number of rivers which they receive, and the little acquaintance we have with the regions through which they run, it is not to be wondered at that geographers are divided concerning the sources of most of them. As among a number of roots by which nourishment is conveyed to a stately tree, it is difficult to determine precisely that by which the tree is chiefly supplied; so among the many branches of a great river, it is equally difficult to tell which is the original. Hence it may easily happen, that a similar branch is taken for the capital stream; and its runnings are pursued, and delineated, in prejudice of some other branch that better deserved the name and the description. In this manner,[4] in Europe, the Danube is known to receive thirty lesser rivers; the Wolga thirty-two or thirty-three. In Asia, the Hohanho receives thirty-five; the Jenisca above sixty; the Oby as many; the Amour about forty; the Nanquin receives thirty rivers; the Ganges twenty; and the Euphrates about eleven. In Africa, the Senegal receives more than twenty rivers; the Nile receives not one for five hundred leagues upwards, and then only twelve or thirteen. In America, the river Amazon receives about sixty, and those very considerable; the river St Lawrence about forty, counting those which fall into its lakes; the Mississippi receives forty; and the river Plate above fifty.

I mentioned the inundations of the Ganges and the Nile; but almost every other great river, whose source lies within the tropics, have their stated inundations also. The river Pegu has been called by travellers, the Indian Nile, because of the similar overflowings of its stream: this it does to an extent of thirty leagues on each side; and so fertilizes the soil, that the inhabitants send great quantities of rice into other countries, and have still abundance for their own consumption. The river Senegal has likewise its inundations, which cover the whole flat country of Negroland, beginning and ending much about the same time with those of the Nile; as, in fact, both rivers rise from the same mountains. But the difference between the effects of the inundations in each river is remarkable; in the one, it distributes health and plenty; in the other, diseases, famine, and death. The inhabitants along the torrid coasts of the Senegal, can receive no benefit from any additional manure the river may carry down to their soil, which is by nature more than sufficiently luxuriant; or, even if they could, they have not industry to turn it to any advantage. The banks, therefore, of the rivers, lie uncultivated, overgrown with rank and noxious herbage, and infested with thousands of animals of various malignity. Every new flood only tends to increase the rankness of the soil, and to provide fresh shelter for the creatures that infest it. If the flood continues but a few days longer than usual, the improvident inhabitants, who are driven up in the higher grounds, want provisions, and a famine ensues. When the river begins to return into its channel, the humidity and heat of the air are equally fatal; and the carcases of infinite numbers of animals, swept away by the inundation, putrefying in the sun, produce a stench that is almost insupportable. But even the luxuriance of the vegetation becomes a nuisance. I have been assured, by persons of veracity who have been up the river Senegal, that there are some plants growing along the coast, the smell of which is so powerful, that it is hardly to be endured. It is certain, that all the sailors and soldiers who have been at any of our factories there, ascribe the unwholesomeness of the voyage up the stream, to the vegetable vapour. However this be, the inundations of the rivers in this wretched part of the globe, contribute scarce any advantage, if we except the beauty of the prospects which they afford. These, indeed are finished beyond the utmost reach of art; a spacious glassy river, with its banks here and there fringed to the very surface by the mangrove-tree, that grows down into the water, presents itself to view; lofty forests of various colours, with openings between, carpeted with green plants, and the most gaudy flowers; beasts and animals, of various kinds, that stand upon the banks of the rivers, and, with a sort of wild curiosity, survey the mariners as they pass, contribute to heighten the scene. This is the sketch of an African prospect; which delights the eye, even while it destroys the constitution.

---

[1] Buffon, vol. ii. p. 82.

[2] We have already stated, that the Himalaya mountains, in Asia, surpass in height those of America.

[3] Ulloa. vol i. p. 388.

[4] Buffon, vol. ii. p. 74.

Besides these annually periodical inundations, there are many rivers that overflow at much shorter intervals. Thus most of those in Peru and Chili have scarce any motion by night; but upon the appearance of the morning sun, they resume their former rapidity: this proceeds from the mountain snows, which, melting with the heat, increase the stream, and continue to drive on the current, while the sun continues to dissolve them. Some rivers also flow with an even steady current, from their source to the sea; others flow with greater rapidity, their stream being poured down in a cataract, or swallowed by the sands, before they reach the sea.

The rivers of those countries that have been least inhabited, are usually more rocky, uneven, and broken into water falls or cataracts, than those where the industry of man has been more prevalent. Wherever man comes, nature puts on a milder appearance: the terrible and the sublime, are exchanged for the gentle and the useful: the cataract is sloped away into a placid stream; and the banks become more smooth and even.[1] It must have required ages to render the Rhone or the Loire navigable: their beds must have been cleaned and directed; their inequalities removed; and by a long course of industry, Nature must have been taught to conspire with the desires of her controller. Every one's experience must have supplied instances of rivers thus being made to flow more evenly, and more beneficially to mankind; but there are some whose currents are so rapid, and falls so precipitate, that no art can obviate; and that must for ever remain as amazing instances of incorrigible nature.

Of this kind are the cataracts of the Rhine; one of which I have seen exhibit a very strange appearance; it was that at Schathausen, which was frozen quite across, and the water stood in columns where the cataract had formerly fallen. The Nile, as was said, has its cataracts. The river Vologda, in Russia, has two. The river Zara, in Africa, has one near its source. The river Velino, in Italy, has a cataract of above an hundred and fifty feet perpendicular. Near the city of Gottenburg,[2] in Sweden, the river rushes down from a prodigious high precipice, into a deep pit, with a terrible noise, and such dreadful force, that those trees designed for the masts of ships, which are floated down the river, are usually turned upside down in their fall, and often are shattered to pieces, by being dashed against the surface of the water in the pit; this occurs if the masts fall side-ways upon the water; but if they fall endways, they dive so far under water, that they disappear for a quarter of an hour, or more: the pit, into which they are thus plunged, has been often sounded with a line of some hundred fathoms long, but no ground has been found hitherto. There is also a cataract at Powers-court, in Ireland, in which, if I am rightly informed, the water falls three hundred feet perpendicular; which is a greater descent than that of any other cataract in any part of the world. There is a cataract at Albany, in the province of New York, which pours its stream fifty feet perpendicular. But of all the cataracts in the world, that of Niagara, in Canada, if we consider the great body of water that falls, must be allowed to be the greatest, and the most astonishing.[3]

---

[1] Buffon, vol. ii. p. 90. [2] Phil. Trans. vol. ii. p. 325

[3] The falls of Niagara afford a magnificent example

This amazing fall of water is made by the river St Lawrence, in its passage from the lake Erie into the lake Ontario. We have already said that the St Lawrence was one of the largest rivers in the world; and yet the whole of its waters are here poured down by a fall of a hundred and fifty feet perpendicular. It is not easy to bring the imagination to correspond with the greatness of the scene; a river, extremely deep and rapid, and that serves to drain the waters of almost all North America into the Atlantic ocean, is here poured precipitately down a ledge of rocks, that rise, like a wall, across the whole bed of its stream. The width of the river, a little above, is near three quarters of a mile broad; and the rocks, where it grows narrower, are four hundred yards over. Their direction is not straight across, but hollowing inwards like a horse-shoe; so that the cataract, which bends to the shape of the obstacle, rounding inwards, presents a kind of theatre the most tremendous in nature. Just in the middle of this circular wall of waters, a little island, that has braved the fury of the current, presents one of its points, and divides the stream at top into two; but it unites again long before it has got to the bottom. The noise of the fall is heard at several leagues distance; and the fury of the waters at the bottom of their fall is inconceivable. The dashing produces a mist that rises to the very clouds; and that produces a most beautiful rainbow, when the sun shines. It may easily be conceived, that such a cataract quite destroys the navigation of the stream; and yet some Indian canoes, as it is said, have been known to venture down it with safety.[1]

---

of the progressive excavation of a deep valley in solid rock. That river flows from Lake Erie to Lake Ontario, the former lake being 330 feet above the latter, and the distance between them being thirty-two miles. On flowing out of the upper lake, the river is almost on a level with its banks; so that if it should rise perpendicularly eight or ten feet, it would lay under water the adjacent flat country of Upper Canada on the west, and of the State of New York on the east. The river, where it issues, is about three quarters of a mile in width. Before reaching the falls, it is propelled with great rapidity, being a mile broad, about twenty-five feet deep, and having a descent of fifty feet in half a mile. An island at the very verge of the cataract divides it into two sheets of water; one of these, called the Horse-Shoo Fall, is six hundred yards wide, and 158 feet perpendicular; the other, called the American Falls, is about two hundred yards in width, and 164 feet in height. The island is about five hundred yards broad. This great sheet of water falls over a ledge of hard limestone, below which is a somewhat greater thickness of soft shale, which crumbling away more rapidly, causes the limestone to form an overhanging mass, projecting forty feet above the hollow space below. (See view of Horse-shoe Fall in Plate I.)

The blasts of wind, charged with spray, which rise out of the pool into which this enormous cascade is projected, strike against the shale beds, so that their disintegration is constant; and the superincumbent limestone, being left without a foundation, falls from time to time in rocky masses. When these enormous fragments descend, a shock is felt at some distance, accompanied by a noise like a distant clap of thunder. After the river has passed over the falls, its character, observes Captain Hall, is immediately and completely changed. It then runs furiously along the bottom of a deep wall-sided valley, or huge trench, which has been cut into the horizontal strata by the continued action of the stream during the lapse of ages. The cliffs on both sides are in most places perpendicular, and the ravine is only perceived on approaching the edge of the precipice.

The waters which expand at the falls, where they are divided by the island, are contracted again, after their union, into a stream not more than 160 yards broad. In the narrow channel, immediately below this immense rush of water, a boat can pass across the stream with ease. The pool, it is said, into which the cataract is precipitated, being 170 feet deep, the descending water sinks down and forms an under-current, while a superficial eddy carries the upper stratum back *towards* the main fall. This is not improbable; and we must also suppose, that the confluence of the two streams, which meet at a considerable angle, tends mutually to neutralize their forces. The bed of the river below the falls is strewed over with huge fragments which have been hurled down into the abyss. By the continued destruction of the rocks, the falls have, within the last forty years, receded nearly fifty yards, or, in other words, the ravine has been prolonged to that extent. Through this deep chasm, the Niagara flows for about seven miles; and then the table-land, which is almost on a level with Lake Erie, suddenly sinks down at a town called Queenstown, and the river emerges from the ravine into a plain which continues to the shores of Lake Ontario.

[1] This is now totally discredited. Indeed it is the general opinion of persons resident in the vicinity of Niagara, that not even the different sorts of fish that happen to be forced down this cataract ever escape with life; and what seems strongly to corroborate this opinion, are the numerous dead fish daily seen floating in the gulf immediately below. Wild-fowl, too, unmindful of their danger, or floated down while they are asleep, find it impossible to escape destruction if once drawn within the verge of the main cataract. In the year 1827, a few individuals agreed to try an experiment, and for this purpose they purchased a large schooner of 140 tons burden, that had previously, during many years, navigated the waters of Lake Erie. This vessel was towed down the river to within half a mile of "the Rapids," where it was cut adrift and left to its fate. The Rapids are caused by numerous ledges of rock, from two to four feet high, extending wholly across the river, over which the water successively pitches for about the distance of one mile, immediately above the main cataract. The vessel got safely over the first ledge, but upon pitching over the second, her masts went by the board, she sprung a leak, and filled with water; but continued nevertheless to float, though she changed her position to stern foremost, in which manner she took her last plunge over the main fall, her bowsprit being the last part that was visible of her. She of course never rose more; but numerous fragments of her timbers and planking were picked up some miles below, in very small pieces,—bruised, torn, and shivered. There were two bears, and some other smaller animals, on board of this vessel when she was cut adrift; but the bears seem to have had some unfavourable misgivings of the safety of the voyage, and, therefore, when she sprung a leak and floated stern foremost, they stepped overboard, and with much difficulty succeeded in swimming ashore, after

Of those rivers that lose themselves in the sands, or are swallowed up by chasms in the earth, we have various information. What we are told by the ancients, of the river Alpheus, in Arcadia, that sinks into the ground, and rises again near Syracuse in Sicily, where it takes the name of Arethusa, is rather more known than credited. But we have better information with respect to the river Tigris being lost in this manner under mount Taurus; of the Guadalquiver, in Spain, being buried in the sands; of the river Greatah, in Yorkshire, running under ground, and rising again; and even of the great Rhine itself, a part of which is no doubt lost in the sands, a little above Leyden. But it ought to be observed of this river, that by much the greatest part arrives at the ocean; for, although the ancient channel which fell into the sea, a little to the west of that city, be now entirely choked up, yet there are still a number of small canals, that carry a great body of water to the sea; and, besides, it has also two very large openings, the Lech and the Waal, below Rotterdam, by which it empties itself abundantly.

Be this as it will, nothing is more common in sultry and sandy deserts, than rivers being thus either lost in the sands, or entirely dried up by the sun. And hence we see, that under the line, the small rivers are but few; for such little streams as are common in Europe, and which with us receive the name of rivers, would quickly evaporate, in those parching and extensive deserts. It is even confidently asserted, that the great river Niger is thus lost before it reaches the ocean; and that its supposed mouths, the Gambia and the Senegal, are distinct rivers, that come a vast way from the interior parts of the country. It appears, therefore, that the rivers under the Line are large; but it is otherwise at the Poles,[1] where they must necessarily be small. In that desolate region, as the mountains are covered with perpetual ice, which melts but little, or not at all, the springs and rivulets are furnished with a very small supply. Here, therefore, men and beasts would perish, and die for thirst, if Providence had not ordered, that in the hardest winter, thaws should intervene, which deposit a small quantity of snow-water in pools under the ice; and from this source the wretched inhabitants drain a scanty beverage.

Thus, whatever quarter of the globe we turn to, we shall find new reasons to be satisfied with that part of it in which we reside. Our rivers furnish all the plenty of the African stream, without its inundation; they have all the coolness of the polar rivulet, with a more constant supply; they may want the terrible magnificence of huge cataracts, or extensive lakes, but they are more navigable, and more transparent; though less deep and rapid than the rivers of the torrid zone, they are more manageable, and only wait the will of man to take their direction. The rivers of the torrid zone, like the monarchs of the country, rule with despotic tyranny; profuse in their bounties, and ungovernable in their rage. The rivers of Europe, like their kings, are the friends, not the oppressors, of the people; bounded by known limits, abridged in the power of doing ill, directed by human sagacity, and only at freedom to distribute happiness and plenty.

CHAP. XV.

OF THE OCEAN IN GENERAL; AND OF ITS SALTNESS.

If we look upon a map of the world, we shall find that the ocean occupies considerably more of the globe than the land is found to do. This immense body of waters is diffused round both the Old and New Continent, to the south; and may surround them also to the north, for what we know, but the ice in those regions has stopped our inquiries. Although the ocean, properly speaking, is but one extensive sheet of waters, continued over every part of the globe, without interruption, and although no part of it is divided from the rest, yet geographers have distinguished it by different names; as, the Atlantic or Western ocean, the Northern ocean, the Southern ocean, the Pacific ocean, and the Indian ocean. Others have divided it differently, and given other names; as the Frozen ocean, the Inferior ocean, or the American ocean. But all these being arbitrary distinctions, and not of Nature's making, the naturalist may consider them with indifference.

In this vast receptacle, almost all the rivers of the earth ultimately terminate; nor do such great supplies seem to increase its stores; for it is neither apparently swollen by their tribute, nor diminished by their failure; it still continues the same. Indeed, what is the quantity of water of all the rivers and lakes in the world, compared to that contained in this great receptacle?[2] If we should offer to make a rude estimate, we shall find that all the rivers in the world, flowing into the bed of the sea, with a continuance of their present

---

having been carried half way down towards the main cataract by the rapidity of the current. No trace of the smaller animals was ever discovered.

[1] Crantz's History of Greenland, vol. i. p. 41.

[2] Buffon, vol. ii. p. 70.

stores, would take up at least eight hundred years to fill it to its present height. For, supposing the sea to be eighty-five millions of square miles in extent, and a quarter of a mile, upon an average, in depth, this, upon calculation, will give about twenty-one millions of cubic miles of water, as the contents of the whole ocean. Now, to estimate the quantity of water which all the rivers supply, take any one of them; the Po, for instance, the quantity of whose discharge into the sea is known to be one cubic mile of water in twenty-six days. Now it will be found, upon a rude computation, from the quantity of ground the Po, with its influent streams, covers, that all the rivers of the world furnish about two thousand times that quantity of water. In the space of a year, therefore, they will have discharged into the sea about twenty-six thousand cubic miles of water; and not till eight hundred years will they have discharged as much water as is contained in the sea at present. I have not troubled the reader with the odd numbers, lest he should imagine I was giving precision to a subject that is incapable of it.

Thus great is the assemblage of waters diffused round our habitable globe; and yet, immeasurable as they seem, they are mostly rendered subservient to the necessities and the conveniences of so little a being as man. Nevertheless, if it should be asked whether they be made for him alone, the question is not easily resolved. Some philosophers have perceived so much analogy to man in the formation of the ocean, that they have not hesitated to assert its being made for him alone. The distribution of land and water,[1] say they, is admirable; the one being laid against the other so skilfully, that there is a just equipoise of the whole globe. Thus the Northern ocean balances against the Southern; and the New Continent is an exact counterweight to the Old. As to any objection from the ocean's occupying too large a share of the globe, they contend, that there could not have been a smaller surface employed to supply the earth with a due share of evaporation. On the other hand, some take the gloomy side of the question; they either magnify[2] its apparent defects; or assert, that what seems defects to us, may be real beauties to some wiser order of beings.[3] They observe, that multitudes of animals are concealed in the ocean, and but a small part of them are known; the rest, therefore, they fail not to say, were certainly made for their own benefit, and not for ours. How far either of these opinions be just, I will not presume to determine; but of this we are certain, that God has endowed us with abilities to turn this great extent of waters to our own advantage. He has made these things, perhaps, for other uses; but he has given us faculties to convert them to our own. This much agitated question, therefore, seems to terminate here. We shall never know whether the things of this world have been made for our use; but we very well know that we have been made to enjoy them. Let us then boldly affirm, that the earth, and all its wonders, are ours; since we are furnished with powers to force them into our service. Man is the lord of all the sublunary creation; the howling savage, the winding serpent, with all the untameable and rebellious offspring of Nature, are destroyed in the contest, or driven at a distance from his habitations. The extensive and tempestuous ocean, instead of limiting or dividing his power, only serves to assist his industry, and enlarge the sphere of his enjoyments. Its billows and its monsters, instead of presenting a scene of terror, only call up the courage of this little intrepid being; and the greatest danger that man now fears on the deep, is from his fellow creatures. Indeed, when I consider the human race as Nature has formed them, there is but very little of the habitable globe that seems made for them. But when I consider them as accumulating the experience of ages, in commanding the earth, there is nothing so great or so terrible. What a poor contemptible being is the naked savage, standing on the beach of the ocean, and trembling at its tumults! How little capable is he of converting its terrors into benefits; or of saying, Behold an element made wholly for my enjoyment! He considers it as an angry deity, and pays it the homage of submission. But it is very different when he has exercised his mental powers; when he has learned to find his own superiority, and to make it subservient to his commands. It is then that his dignity begins to appear, and that the true Deity is justly praised for having been mindful of man: for having given him the earth for his habitation, and the sea for an inheritance.

This power which man has obtained over the ocean, was at first enjoyed in common; and none pretended to a right in that element where all seemed intruders. The sea, therefore, was open to all, till the time of the emperor Justinian. His successor Leo granted such as were in possession of the shore, the sole right of fishing before their respective territories. The Thracian Bosphorus was the first that was thus appropriated; and from that time it has been the struggle of most of the powers of Europe to obtain an exclusive right in this element. The republic of Ve-

---

[1] Derham's Physico-Theol.

[2] Burnet's Theory, passim.

[3] Pope's Ethic Epistles, passim.

-nice claims the Adriatic. The Danes are in possession of the Baltic. But the English have a more extensive claim to the empire of all the seas encompassing the kingdoms of England, Scotland, and Ireland; and although these have been long contested, yet they are now considered as their indisputable property. Every one knows that the great power of the nation is exerted on this element; and that the instant England ceases to be superior upon the ocean, its safety begins to be precarious.

It is in some measure owing to our dependence upon the sea, and to our commerce there, that we are so well acquainted with its extent and figure. The bays, gulfs, currents, and shallows of the ocean, are much better known and examined than the provinces and kingdoms of the earth itself. The hopes of acquiring wealth by commerce, has carried man to much greater length than the desire of gaining information could have done. In consequence of this, there is scarce a strait or a harbour, scarce a rock or a quick-sand, scarce an inflexion of the shore, or the jutting of a promontory, that has not been minutely described. But as these present very little entertainment to the imagination, or delight to any but those whose pursuits are lucrative, they need not be dwelt upon here. While the merchant and the mariner are solicitous in describing currents and soundings, the naturalist is employed in observing wonders, though not so beneficial, yet to him of a much more important nature. The saltness of the sea seems to be foremost.

Whence the sea has derived that peculiar bitterish saltness which we find in it, appears, by Aristotle, to have exercised the curiosity of naturalists in all ages. He supposed (and mankind were for ages content with the solution) that the sun continually raised dry saline exhalations from the earth, and deposited them upon the sea; and hence, say his followers, the waters of the sea are more salt at top than at bottom. But, unfortunately for this opinion, neither of the facts is true. Sea-salt is not to be raised by the vapours of the sun; and sea-water is not salter at the top than at the bottom. Father Bohouris is of opinion, that the Creator gave the waters of the ocean their saltness at the beginning: not only to prevent their corruption, but to enable them to bear greater burthens. But their saltness does not prevent their corruption; for stagnant sea-water, like fresh, soon grows putrid: and, as for their bearing greater burthens, fresh water answers all the purposes of navigation quite as well. The established opinion, therefore, is that of Boyle,[1] who supposes, "That the sea's saltness is supplied not only from rocks or masses of salt at the bottom of the sea, but also from the salt which the rains, and rivers, and other waters, dissolve in their passage through many parts of the earth, and at length carry with them to the sea." But as there is a difference in the taste of rock-salt found at land, and that dissolved in the waters of the ocean, this may be produced by the plenty of nitrous and bituminous bodies that, with the salts, are likewise washed into that great receptacle. These substances being thus once carried to the sea, must for ever remain there; for they do not rise by evaporation so as to be returned back from whence they came. Nothing but the fresh waters of the sea rise in vapours; and all the saltness remains behind. From hence it follows, that every year the sea must become more and more salt; and this speculation Dr Halley carries so far as to lay down a method of finding out the age of the world by the saltness of its waters. "For if it be observed," says he, "what quantity of salt is at present contained in a certain weight of water taken up from the Caspian Sea, for example, and, after some centuries what greater quantity of salt is contained in the same weight of water, taken from the same place; we may conclude, that in proportion as the saltness has increased in a certain time, so much must it have increased before that time; and we may thus, by the rule of proportion, make an estimate of the whole time wherein the water would acquire the degree of saltness it should be then possessed of."[2] All this may be fine: however, an experiment, begun in this century, which is not to be completed till some centuries hence, is rather a little mortifying to modern curiosity; and I am induced to think, the inhabitants round the Caspian Sea will not be apt to undertake the inquiry.

This saltness is found to prevail in every part of the ocean; and as much at the surface as at the bottom. It is also found in all those seas that communicate with the ocean; but rather in a less degree.

The great lakes, likewise, that have no outlets nor communication with the ocean, are found to be salt; but some of them in less proportion. On the contrary, all those lakes through which rivers run into the sea, however extensive they be, are, notwithstanding, very fresh: for the rivers do not deposite their salts in the bed of the lake, but carry them with their currents into the ocean. Thus the lakes Ontario and Erie, in North America, although for magnitude they may be considered as inland seas, are nevertheless fresh-water lakes; and kept so by the river St Lawrence, which passes through them. But those lakes that have no communication with the sea, nor any rivers going out, although they be less than the former, are, however, always salt. Thus, that which goes by the name of the Dead Sea, though very small, when compared to those already mentioned, is so exceedingly salt, that its waters seem scarcely capable of dissolving any more. The lakes of Mexico and of Titicaca in Peru, though of no great extent, are nevertheless salt; and both for the same reason.[1]

---

[1] Boyle, vol. iii p. 221

[2] Phil. Trans. vol. v. p. 218.

Those who are willing to turn all things to the best, have not failed to consider this saltness of the sea as a peculiar blessing from providence, in order to keep so great an element sweet and wholesome. What foundation there may be in the remark, I will not pretend to determine; but we shall shortly find a much better cause for its being kept sweet, namely, its motion.

On the other hand, there have been many who have considered the subject in a different light, and have tried every endeavour to make salt-water fresh, so as to supply the wants of mariners, in long voyages, or when exhausted of their ordinary stores. At first it was supposed simple distillation would do; but it was soon found, that the bitter part of the water still kept mixed. It was then tried by uniting salt of tartar with sea-water, and distilling both, but here the expense was greater than the advantage. Calcined bones were next thought of; but a hogshead of calcined bones, carried to sea, would take up as much room as a hogshead of water, and was more hard to be obtained. In this state, therefore, have the attempts to sweeten sea-water rested; the chemist, satisfied with the reality of his invention, and the mariner convinced of its being useless. I cannot, therefore, avoid mentioning a kind of succedaneum which has been lately conceived to answer the purposes of fresh water, when mariners are quite exhausted. It is well known, that persons who go into a warm bath, come out several ounces heavier than they went in; their bodies having imbibed a correspondent quantity of water. This more particularly happens, if they have been previously debarred from drinking, or go in with a violent thirst; which they quickly find quenched, and their spirits restored. It was supposed, that in case of a total failure of fresh water at sea, a warm bath might be made of sea-water, for the use of mariners; and that their pores would thus imbibe the fluid, without any of its salts, which would be seen to crystallize on the surface of their bodies. In this manner, it is supposed, a sufficient quantity of moisture may be procured to sustain life, till time or accident furnish a more copious supply.

But however this be, the saltness of the sea can by no means be considered as a principal cause in preserving its waters from putrefaction. The ocean has its currents, like rivers which circulate its contents round the globe; and these may be said to be the great agents that keep it sweet and wholesome. Its saltness alone would by no means answer this purpose: and some have even imagined that the various substances with which it is mixed, rather tend to promote putrescence than impede it. Sir Robert Hawkins, one of our most enlightened navigators, gives the following account of a calm in which the sea, continuing for some time without motion, began to assume a very formidable appearance. "Were it not," says he, "for the moving of the sea, by the force of winds, tides, and currents, it would corrupt all the world. The experiment of this I saw in the year 1590, lying with a fleet about the islands of the Azores, almost six months; the greatest part of which time we were becalmed. Upon which all the sea became so replenished with several sorts of jellies, and of serpents, adders, and snakes, as seemed wonderful; some green, some black, some yellow, some white, some of divers colours; and many of them had life; and some there were a yard and a half, and two yards long: which had I not seen, I could hardly have believed. And hereof are witnesses all the company of the ships which were then present; so that hardly a man could draw a bucket of water clear of some corruption. In which voyage towards the end thereof, many of every ship fell sick, and began to die apace. But the speedy passage into our country was a remedy to the crazed, and a preservative for those that were not touched."

This shows abundantly how little the sea's saltness was capable of preserving it from putrefaction; but to put the matter beyond all doubt, Mr Boyle kept a quantity of sea-water, taken up in the English Channel, for some time barrelled up; and in the space of a few weeks it began to acquire a fetid smell.[2] He was also assured, by one of his acquaintance, who was becalmed for twelve or fourteen days in the Indian Sea, that the water for want of motion began to stink; and that had it continued much longer, the stench would probably have poisoned him. It is the motion, therefore, and not the saltness of the sea, that preserves it in its present state of salubrity; and this, very probably, by dashing and breaking in pieces the rudiments, if I may so call them, of the various animals that would otherwise breed there, and putrefy.

---

[1] There are many countries on the habitable globe where salt has never yet been found, and whose commercial facilities being extremely limited, the inhabitants can only occasionally indulge themselves with it as a luxury. This is particularly the case in the interior of Africa. "It would," says Mungo Park, "appear strange to an European to see a child suck a piece of rock-salt as if it were sugar. This, however, I have frequently seen; although the poorer class of inhabitants are so very rarely indulged with this precious article, that to say that a man eats salt with his provisions, is the same as saying he is a rich man. I have suffered great inconvenience myself from the scarcity of this article. The long use of vegetable food creates so painful a longing for salt, that no words can sufficiently describe it."—*Park's Travels into the Interior of Africa.*

[2] Boyle, vol. iii. p. 222.

There are some advantages, however, which are derived from the saltness of the sea. Its waters being evaporated, furnish that salt which is used for domestic purposes; and although in some places it is made from springs, and in others dug out of mines, yet the greatest quantity is made only from the sea. That which is called *bay salt*, (from its coming to us by the Bay of Biscay,) is a stronger kind, made by evaporation in the sun; that called *common salt*, is evaporated in pans over the fire, and is of a much inferior quality to the former.[1]

Another benefit arising from the quantity of salt dissolved in the sea is, that it thus becomes heavier, and consequently more buoyant. Mr Boyle, who examined the difference

---

[1] Common salt is found in a solid state as "rock-salt," or is obtained by evaporating sea or salt-spring water. The evaporating process is conducted either by exposing the liquid to the atmosphere, or by boiling it over a fire. In countries where the rays of the sun possess sufficient heat to occasion rapid evaporation, salt of the finest quality is obtained without the assistance of artificial heat. The sea-water is enclosed in salt-pans, or shallow pits lined with clay: as the evaporation advances, and the salt is deposited, the brine is pumped off till a crust of salt about three inches thick remains. When this crust becomes hard it is broken up, and deposited in heaps in a place protected from rain. A fluid called the *bittern*, containing a number of the earthy bitter salts, continues for a long time to drain from the heaps; the salt indeed is not considered perfectly good till after three years' draining. The result of this process is the "bay salt," so much in request for preserving animal food. The "bittern" is sometimes preserved for the purpose of obtaining from it the sulphate of magnesia, and other substances containing magnesia. Glauber's salts are made from it.

In countries where the sun's heat is too weak to effect evaporation with sufficient rapidity, and where, at the same time, fuel is cheap, the other process of boiling the liquor is adopted. The boiling is repeated four or even seven times, the boiler being each time replenished with fresh brine. When the liquor is sufficiently evaporated, the salt is left in crystals at the bottom of the pan. From a pan of 1300 gallons from fifteen to twenty bushels of salt are obtained every day. In this process the draining which the salt requires after being removed from the boiler seldom takes more than four days. Not only brine must be subjected to the process of evaporation, but even rock-salt, if impure, must be dissolved in water, and again consolidated by heat.

It is supposed that brine-springs are formed by a stream of water flowing through a stratum of rock-salt. It is stated that charcoal is very generally found in strata above brine springs. Such springs are very numerous in America, and are extensively used in the manufacture of salt. They appear also to be generally of greater strength than the springs of Europe. Yet some of those in England are remarkably strong. Though the strongest brines can yield little more than one-fourth of their weight in salt, the springs of Cheshire afford 22 per cent., in one remarkable case 25 per cent. and in another even 26 per cent. In Switzerland, from 13 to 14 per cent. is the usual strength of the salt-brine springs, and the average is only 11 per cent. in France.

Dr Reusselaer conjectures that rock-salt is composed of deposits from salt-lakes, or seas, which have now ceased to exist. Some of the salt strata are considerably above the present level of the ocean. In the Tyrol they are 5000 feet, and in Peru 10,000 feet, above the level of the sea. In England, on the contrary, strata are found 420 feet *below* that level. The Zout pans in Africa are deposits of salt in crystals, which Dr Reusselaer concludes to have been wafted from the coast, where a great evaporation of the sea water is produced by the action of the sun; and this opinion is authorized by that saltness of the air between the coast and the interior which travellers have remarked.

Salt-rocks and strata are found in all parts of the globe. Dr Reusselaer states that they extend across America from the Alleghany Mountains to the Pacific, and are found in California. In Mexico the Pennon Blanco are salt-rocks which are worked, and annually produce 1,786,000 bushels of salt. In England the great depositories of rock-salt are in Cheshire, where are also the brine-springs mentioned before. In 1819 six distinct strata of very fine rock-salt were discovered at Vic, in the department of Meurthe, in France; but no use appears to have been made of the discovery. Spain has a singular mountain of salt near Cardona in Catalonia. It is a mass of solid salt, between 400 and 500 feet high, and nearly three miles in circumference. The salt is of various colours, but generally white, transparent as crystal, and remains a considerable time insoluble in water. The inhabitants make it into vases, urns, candlesticks, and other toys and utensils. At La Mancha there is a smaller but similar mass of salt; and near the Ebro is a chain of hills, consisting of salt, sulphate of lime, and limestone. In Germany there are masses of rock-salt in Upper Austria, Styria, Bavaria, Wurtemburg, and the Tyrol. In Hungary and Poland there is an immense deposit of rock-salt on both sides the Carpathian mountains. It is also found near Ockna, in Moldavia, in Transylvania, and in Calabria. In Caramania, in Asiatic Turkey, it is said to be used for building. The Isle of Ormus, in the Persian Gulf, is a solid mass of fossil salt. In Caubul a road is cut through a mass of rock salt that rises in a cliff more than 100 feet above the river. In Africa rock-salt is very abundant: on both sides the Atlas Mountains it occurs in great quantities, and is found in Tunis and Algiers. In Abyssinia there is an immense plain of salt, four days' journey in extent.

The uses of salt are very various in manufactures. It enters into the composition of sal-ammoniac,—of glass,—of oxymuriate of lime,—of corrosive sublimate,—of Glauber's and Epsom salts, and of the painter's patent yellow; and it is used in bleaching,—in glazing earthenware,—in assaying metals,—in case-hardening steel, and in rendering iron malleable. But the qualities of salt which render it indispensable to man are its uses as mixed with his food. With every bushel of flour about one pound of salt is used in making bread; thus, it may be presumed that, in bread alone, every adult consumes about two ounces of salt weekly. Salt is *antiseptic* (counteracts putrefaction); and hence meats and fish are preserved by salting. In using salt for this purpose, it between sea-water and fresh, found that the former appeared to be about a forty-fifth part heavier than the latter. Those, also, who have had opportunities of bathing in the sea, pretend to have experienced a much greater ease in swimming there than in fresh water. However, as we see they have only a forty-fifth part more of their weight sustained by it, I am apt to doubt whether so minute a difference can be practically perceivable. Be this as it may, as sea-water alters in its weight from fresh so it is found also to differ from itself in different parts of the ocean. In general, it is perceivable to be heavier, and consequently salter, the nearer we approach the Line.[1]

But there is an advantage arising from the saltness of the waters of the sea, much greater than what has been yet mentioned; which is, that their congelation is thus retarded. Some indeed have gone so far as to say, that sea-water never freezes;[2] but this is an assertion contradicted by experience. However it is certain, that it requires a much greater degree of cold to freeze it than fresh water; so that while rivers and springs are seen converted into one solid body of ice, the sea is always fit for navigation, and no way affected by the coldness of the severest winter. It is, therefore, one of the greatest blessings we derive from this element that, when at land all the stores of nature are locked up from us, we find the sea ever open to our necessities, and patient of the hand of industry.

But it must not be supposed, because in our temperate climate we never see the sea frozen, that it is in the same manner open in every part of it. A very little acquaintance with the accounts of mariners, must have informed us, that at the polar regions it is embarrassed with mountains and moving sheets of ice, that often render it impassable. These tremendous floats are of different magnitudes; sometimes rising more than a thousand feet above the surface of the water;[3] sometimes diffused into plains of above two hundred leagues in length; and, in many parts, sixty or eighty broad. They are usually divided by fissures; one piece following another so close, that a person may step from one to the other. Sometimes mountains are seen rising amidst these plains, and presenting the appearance of a variegated landscape, with hills and valleys, houses, churches, and towers. These are appearances in which all naturalists are agreed; but the great contest is respecting their formation. Mr Buffon asserts,[4] that they are formed from fresh water alone, which congealing at the mouths of great rivers, accumulate those huge masses that disturb navigation. However, this great naturalist seems not to have been aware, that there are two sorts of ice floating in these seas; the flat ice and the mountain ice: the one formed of sea-water only; the other of fresh.[5]

The flat, or driving ice, is entirely composed of sea-water; which, upon dissolution, is found to be salt; and is readily distinguished from the mountain, or fresh water ice, by its whiteness, and want of transparency. This ice is much more terrible to mariners than that which rises up in lumps; a ship can avoid the one, as it is seen at a distance; but it often gets in among the other, which, sometimes closing, crushes it to pieces. This, which manifestly has a different origin from the fresh-water ice, may perhaps have been produced in the Icy Sea, beneath the pole; or along the coasts of Spitzbergen or Nova-Zembla. (*See view of Iceberg in Plate I.*)

The mountain ice, as was said, is different in every respect, being formed of fresh water, and appearing hard and transparent; it is generally of a pale green colour, though some pieces are of a beautiful sky-blue; many large masses also appear gray, and some black. If examined more nearly, they are found to be incorporated with earth, stones, and brushwood, washed from the shore. On these also are sometimes found, not only earth, but nests with birds' eggs, at several hundred miles from land. The generality of these, though almost totally fresh, have nevertheless a thick crust of salt-water frozen upon them, probably from the power that ice has sometimes to produce ice. Such mountains as are here described, are most usually seen at spring-time, and after a violent storm, driving out to sea, where they at first terrify the mariner, and are soon after dashed to pieces by the continual

---

should be free from the muriate of magnesia, which attracts moisture. The importance of salt for the support of life is evident, when we consider how much fish and flesh are thus preserved, to be removed from places where they could not be used fresh, to be distributed and consumed gradually through a whole country. In countries where salt is scarce, the want is severely felt. In the States of La Plata, in South America, the sheep and cattle, where they discover a pit of salt-clay, rush together to feed upon it; and, in the struggle, many are trodden to death. In Upper Canada the cattle have plenty of wild pasture to browse on in the woods; but once in a fortnight they return to the farm of their own accord in order to obtain a little salt; and when they have eaten it, mixed with their fodder, they return again to the woods. Salt is now extensively used in England, and in all Europe, for fattening cattle. In Spain they attribute the fineness of their wool to the quantities of salt given to the sheep. In England, 1000 sheep consume at the rate of a ton of salt annually. About 1,000,000 tons annually are given to animals in this country. It is also much in use as a manure for the soil. The proportion of half-a-peck of salt to an area of soil equal to forty yards long by one broad has been found to succeed.

[1] Phil. Trans. vol. ii. p. 297.

[2] Macrobius.

[3] Crantz's History of Greenland, vol. i. p. 31.

[4] Buffon, vol. ii. p. 91.

[5] Crantz.

washing of the waves; or driven into the warmer regions of the south, there to be melted away. They sometimes, however, strike back upon their native shores, where they seem to take root at the feet of mountains; and, as Martius tells us, are sometimes higher than the mountains themselves. Those seen by him were blue, full of celfts and cavities made by the rain, and crowned with snow, which alternately thawing and freezing every year, augmented their size. These, composed of materials more solid than that driving at sea, presented a variety of agreeable figures to the eye, that with a little help from fancy assumed the appearance of trees in blossom; the inside of churches, with arches, pillars, and windows; and the blue-coloured rays, darting from within, presented the resemblance of a glory.

If we inquire into the origin and formation of these, which, as we see, are very different from the former, I think we have a very satisfactory account of them in Crantz's History of Greenland; and I will take leave to give the passage with a very few alterations. "These mountains of ice," says he, "are not salt, like the sea-water, but sweet; and, therefore, can be formed no where except on the mountains, in rivers, in caverns, and against the hills near the sea-shore. The mountains of Greenland are so high that the snow which falls upon them, particularly on the north side, is in one night's time wholly converted into ice: they also contain clefts and cavities, where the sun seldom or never injects his rays; besides these, are projections, or landing places, on the declivities of the steepest hills, where the rain and snow-water lodge, and quickly congeal. When now the accumulated flakes of snow slide down, or fall with the rain from the eminences above on these prominences; or, when here and there a mountain-spring comes rolling down to such a lodging-place, where the ice has already seated itself, they all freeze, and add their tribute to it. This, by degrees, waxes to a body of ice, that can no more be overpowered by the sun; and which, though it may indeed, at certain seasons, diminish by a thaw, yet, upon the whole, through annual acquisitions, assumes an annual growth. Such a body of ice is often prominent far over the rocks. It does not melt on the upper surface, but underneath; and often cracks into many larger or smaller clefts, from whence the thawed water trickles out. By this it becomes at last so weak, that being overloaded with its own ponderous bulk, it breaks loose, and tumbles down the rocks with a terrible crash. Where it happens to overhang a precipice on the shore, it plunges into the deep with a shock like thunder; and with such an agitation of the water, as will overset a boat at some distance, as many a poor Greenlander has fatally experienced." Thus are these amazing ice-mountains launched forth to sea, and found floating in the waters round both the poles. It is these that have hindered mariners from discovering the extensive countries that lie round the South Pole; and that probably block up the passage to China by the North.

I will conclude this chapter with one effect more, produced by the saltness of the sea; which is the luminous appearance of its waves in the night. All who have been spectators of a sea by night, a little ruffled with winds, seldom fail of observing its fiery brightness. In some places it shines as far as the eye can reach;[1] at other times, only when the waves boom against the side of the vessel, or the oar dashes into the water. Some seas shine often; others more seldom; some, ever when particular winds blow; and others, within a narrow compass; a long tract of light being seen along the surface, whilst all the rest is hid in total darkness. It is not easy to account for these extraordinary appearances: some have supposed that a number of luminous insects produced the effect, and this is in reality sometimes the case; in general, however, they have every resemblance to that light produced by electricity; and, probably, arise from the agitation and dashing of the saline particles of the fluid against each other. But the manner in which this is done, for we can produce nothing similar by any experiments hitherto made, remains for some happier accident to discover. Our progress in the knowledge of nature is slow; and it is a mortifying consideration, that we are hitherto more indebted for success to chance than industry.

CHAP. XVI.

OF THE TIDES, MOTION, AND CURRENTS, OF THE SEA; WITH THEIR EFFECTS.

It was said in the former chapter, that the waters of the sea were kept sweet by their motion; without which they would soon putrefy, and spread universal infection. If we look for final causes, here indeed we have a great and an obvious one that presents itself before us. Had the sea been made without motion, and resembling a pool of stagnant water, the noble races of animated nature would shortly be at an end. Nothing would then be left alive but swarms of ill-formed creatures, with scarcely more than vegetable life; and subsisting by putrefaction. Were this extensive bed of waters entirely quiescent, millions of the smaller reptile kinds would there find a proper retreat to breed and multiply in; they would find there no agitation, no concussion in the parts of the fluid to crush their feeble frames, or to force them from the places where they were bred: there they would multiply, in security and ease, enjoy a short life, and putrefying, thus again give nourishment to numberless others, as little worthy of existence as themselves. But the motion of this great element effectually destroys the number of these viler creatures; its currents and its tides produce continual agitations, the shock of which they are not able to endure; the parts of the fluid rubbing against each other, destroy all viscidities; and the ocean, if I may so express it, acquires health by exercise.[1]

---

[1] Boyle, vol. i. p. 294.

The most obvious motion of the sea, and the most generally acknowledged, is that of its tides. This element is observed to flow for certain hours, from the south towards the north; in which motion or flux, which lasts about six hours, the sea gradually swells; so that entering the mouth of rivers, it drives back the river-waters to their heads. After a continual flux of six hours, the sea seems to rest for a quarter of an hour; and then begins to ebb, or retire back again, from north to south, for six hours more; in which time the waters sinking, the rivers resume their natural course. After a seeming pause of a quarter of an hour, the sea begins again to flow as before: and thus it has alternately risen and fallen twice a day since the creation.

This amazing appearance did not fail to excite the curiosity, as it did the wonder of the ancients. After some wild conjectures of the earliest philosophers, it became well known in the time of Pliny, that the tides were entirely under the influence, in a small degree, of the sun; but in a much greater of the moon. It was found that there was a flux and reflux of the sea, in the space of twelve hours fifty minutes, which is exactly the time of a lunar day. It was observed, that whenever the moon was in the meridian, or in other words, as nearly as possible over any part of the sea, that the sea flowed to that part, and made a tide there; on the contrary, it was found, that when the moon left the meridian, the sea began to flow back again from whence it came; and there might be said to ebb. Thus far the waters of the sea seemed very regularly to attend the motion of the moon. But as it appeared likewise, that when the moon was in the opposite meridian, as far off on the other side of the globe, that there was a tide on this side also; so that the moon produced two tides, one by her greatest approach to us, and another by her greatest distance from us: in other words, the moon, in once going round the earth, produced two tides, always at the same time; one on the part of the globe directly under her; and the other, on the part of the globe directly opposite.

Mankind continued for several ages content with knowing the general cause of these wonders, hopeless of discovering the particular manner of the moon's operation. Kelper was the first who conjectured that attraction was the principal cause; asserting, that the sphere of the moon's operation extended to the earth, and drew up its waters. The precise manner in which this is done, was discovered by Newton.

The moon has been found, like all the rest of the planets, to attract and to be attracted by the earth. This attraction prevails throughout our whole planetary system. The more matter there is contained in any body, the more it attracts; and its influence decreases in proportion as the distance, when squared, increases. This being premised, let us see what must ensue upon supposing the moon in the meridian of any tract of the sea. The surface of the water immediately under the moon, is nearer the moon than any other part of the globe is; and, therefore, must be more subject to its attraction, than the waters any where else. The waters will, therefore, be attracted by the moon, and rise in a heap; whose eminence will be the highest where the attraction is the greatest. In order to form this eminence, it is obvious that the surface, as well as the depth, will be agitated; and that wherever the water runs from one part, succeeding waters must run to fill up the space it has left. Thus the waters of the sea, running from all parts to attend the motion of the moon, produce the flowing of the tide; and it is high tide at that part wherever the moon comes over it, or to its meridian.

---

[1] The velocity of waves has relation to their magnitude. Some large waves proceed at the rate of from thirty to forty miles an hour. It is a vulgar belief that the water itself advances with the speed of the wave, but in fact the *form* only advances, while the *substance*, except a little spray above, remains rising and falling in the same place, according to the laws of the pendulum. A wave of water, in this respect, is exactly imitated by the wave running along a stretched rope when one end of it is shaken; or by the mimic waves of our theatres, which are generally the undulations of long pieces of carpet moved by attendants. But when a wave reaches a shallow bank or beach, the water becomes really progressive, because then, as it cannot sink directly downwards, it falls over and forwards, seeking its level. So awful is the spectacle of a storm at sea, that it is generally viewed through a medium which biases the judgment; and, lofty as waves really are, imagination makes them loftier still. No wave rises more than ten feet above the ordinary level, which, with the ten feet that its surface afterwards descends below this, gives twenty feet for the whole height, from the bottom of any water-valley to the summit. This proposition is easily proved, by trying the height upon a ship's mast at which the horizon is always in sight over the tops of the waves; allowance being made for accidental inclinations of the vessel, and for her sinking in the water to much below her water-line at the instant when she reaches the bottom of the hollow between two waves. The spray of the sea, driven along by the violence of the wind, is of course much higher than the summit of the liquid wave; and a wave coming against an obstacle, may dash to almost any elevation above it. At the Eddystone Lighthouse, when a surge reaches it, which has been growing under a storm all the way across the Atlantic, it dashes even over the lantern at the summit.—*Arnot's Elements of Physic.*

But when the moon travels onward, and ceases to point over the place where the waters were just risen, the cause here of their rising ceasing to operate, they will flow back by their natural gravity into the lower parts from whence they had travelled; and this retiring of the waters will form the ebbing of the sea.

Thus the first part of the demonstration is obvious; since, in general, it requires no great sagacity to conceive that the waters nearest the moon are most attracted, or raised highest by the moon. But the other part of the demonstration, namely, how there come to be high tides at the same time, on the opposite side of the globe, and where the waters are farthest from the moon, is not so easy to conceive. To comprehend this, it must be observed, that the part of the earth and its waters that are farthest from the moon, are the parts of all others that are least attracted by the moon; it must also be observed, that all the waters, when the moon is on the opposite side of the earth, must be attracted by it in the same direction that the earth itself attracts them; that is, if I may so say, quite through the body of the earth, towards the moon itself. This, therefore, being conceived, it is plain that those waters which are farthest from the moon, will have less weight than those of any other part, on the same side of the globe; because the moon's attraction, which conspires with the earth's attraction, is there least. Now, therefore, the waters farthest from the moon, having less weight, and being lightest, will be pressed on all sides, by those that, having more attraction, are heavier: they will be pressed, I say, on all sides; and the heavier waters flowing in, will make them swell and rise, in an eminence directly opposite to that on the other side of the globe, caused by the more immediate influence of the moon.

In this manner the moon, in one diurnal revolution, produces two tides; one raised immediately under the sphere of its influence, and the other directly opposite to it. As the moon travels, this vast body of waters rears upward, as if to watch its motions; and pursues the same constant rotation. However, in this great work of raising the tides, the sun has no small share; it produces its own tides constantly every day, just as the moon does, but in a much less degree, because the sun is at an immensely greater distance. Thus there are solar tides, and lunar tides. When the forces of these two great luminaries concur, which they always do when they are either in the same, or in opposite parts of the heavens, they jointly produce a much greater tide than when they are so situated in the heavens, as each to make peculiar tides of their own. To express the very same thing technically; in the conjunctions and oppositions of the sun and moon, the attraction of the sun conspires with the attraction of the moon; by which means the high spring-tides are formed. But in the quadratures of the sun and moon, the water raised by the one is depressed by the other; and hence the lower neap-tides have their production. In a word, the tides are greatest in the syzigies, and least in the quadratures.

This theory well understood, and the astronomical terms previously known, it may readily be brought to explain the various appearances of the tides, if the earth were covered with a deep sea, and the waters uninfluenced by shoals, currents, straits, or tempests. But in every part of the sea, near the shores, the geographer must come in to correct the calculations of the astronomer. For, by reason of the shallowness of some places, and the narrowness of the straits in others, there arises a great diversity in the effect, not to be accounted for without an exact knowledge of all the circumstances of the place. In the great depths of the ocean, for instance, a very slow and imperceptible motion of the whole body of water will suffice to raise its surface several feet high; but if the same increase of water is to be conveyed through a narrow channel, it must rush through it with the most impetuous rapidity. Thus, in the English channel, and the German ocean, the tide is found to flow strongest in those places that are narrowest; the same quantity of water being, in this case, driven through a smaller passage. It is often seen, therefore, pouring through a strait with great force; and, by its rapidity, considerably raised above the surface of that part of the ocean into which it runs.

This shallowness and narrowness in many parts of the sea, give also rise to a peculiarity in the tides of some parts of the world. For in many places, and in our own seas in particular, the greatest swell of the tide is not while the moon is in its meridian height, and directly over the place, but some time after it has declined from thence. The sea, in this case, being obstructed, pursues the moon with what despatch it can, but does not arrive with all its waters till long after the moon has ceased to operate. Lastly, from the shallowness of the sea, and from its being obstructed by shoals and straits, we may account for the Mediterranean, the Baltic, and the Black sea, having no sensible tides. These, though to us they seem very extensive, are not however large enough to be affected by the influence of the moon; and as to their communication with the ocean, through such narrow inlets, it is impossible, in a few hours' time, that they should receive and return water enough to raise or depress them in any considerable degree.

In general, therefore, we may observe, that all tides are much higher, and more considerable, in the torrid zone, than in the rest of the ocean; the sea in those parts being generally deeper, and less affected by changeable winds, or winding shores.[1] The greatest tide we know of, is that at the mouth of the river Indus, where the water rises thirty feet in height. How great, therefore, must have been the amazement of Alexander's soldiers at so strange an appearance! They who always before had been accustomed only to the scarcely perceptible risings of the Mediterranean, or the minute intumescense of the Black sea, when made at once spectators of a river rising and falling thirty feet in a few hours, must, no doubt, have felt the most extreme awe and, as we are told,[2] a mixture of curiosity and apprehension. The tides are also remarkably high on the coasts of Malay, in the straits of Sunda, in the Red sea, at the mouth of the river St Lawrence, along the coasts of China and Japan, at Panama, and in the gulf of Bengal. The tides at Tonquin, however, are the most remarkable in the world. In this part there is but one tide, and one ebb, in twenty-four hours; whereas, as we have said before, in other places there are two. Besides, there, twice in each month, there is no tide at all, when the moon is near the equinoctial, the water being for some time quite stagnant. These, with some other odd appearances attending the same phenomena, were considered by many as inscrutable; but Sir Isaac Newton, with peculiar sagacity, adjudged them to arise from the concurrence of two tides, one from the South sea, and the other from the Indian ocean. Of each of these tides there come successively two every day: two at one time greater, and two at another that are less. The time between the arrival of the two greater, is considered by him as high tide; the time between the two lesser, as ebb. In short, with this clue, that great mathematician solved every appearance, and so established his theory as to silence every opposer.

This fluctuation of the sea from the tides, produces another, and more constant rotation of its waters, from the east to the west, in this respect following the course of the moon. This may be considered as one great and general current of the waters of the sea; and although it be not every where distinguishable, it is nevertheless every where existent, except when opposed by some particular current or eddy, produced by partial and local causes. This tendency of the sea towards the west, is plainly perceivable in all the great straits of the ocean; as, for instance, in those of Magellan, where the tide running in from the east, rises twenty feet high, and continues flowing six hours; whereas the ebb continues but two hours, and the current is directed to the west. This proves that the flux is not equal to the reflux; and that from both results a motion of the sea westward, which is more powerful during the time of the flux than the reflux.

But this motion westward has been sensibly observed by navigators, in their passage back from India to Madagascar, and so on to Africa. In the great Pacific ocean also it is very perceivable; but the places where it is most obvious, are, as was said, in those straits which join one ocean to another. In the straits between the Maldivia islands, in the gulf of Mexico, between Cuba and Jucatan. In the straits of the gulf of Paria, the motion is so violent, that it hath received the appellation of the Dragon's mouth. Northward, in the sea of Canada, in Waigat's straits, in the straits of Java, and, in short, in every strait where the ocean on one part pours into the ocean on the other. In this manner, therefore, is the sea carried with an unceasing circulation round the globe; and at the same time that its waters are pushed backward and forward with the tide, they have thus a progressive current to the west, which though less observable, is not the less real.

Beside these two general motions of the sea, there are others which are particular to many parts of it, and are called currents. These are found to run in all directions, east, west, north, and south; being formed, as was said above, by various causes; the prominence of the shores, the narrowness of the straits, the variations of the wind, and the inequalities at the bottom. These, though no great object to the philosopher, as their causes are generally local and obvious, are nevertheless of the most material consequence to the mariner; and without a knowledge of which he could never succeed. It often has happened, that when a ship has unknowingly got into one of these, every thing seems to go forward with success, the mariners suppose themselves every hour approaching their wished-for port, the wind fills their sails, and the ship's prow seems to divide the water; but, at last by miserable experience they find that, instead of going forward, they have been all the time receding. The business of currents therefore, makes a considerable article in navigation; and the direction of their stream, and their rapidity, has been carefully set down. This some do by the observation of the surface of the current; or by the driving of the froth along the shore; or by throwing out what is called the *log-line*, with a buoy made for that purpose, and by the direction and motion of this, they judge of the setting and rapidity of the current.

---

[1] Buffon, vol. ii. p. 187.

[2] Quintus Curtius.

These currents are generally found to be most violent under the equator, where indeed all the motions of the ocean are most perceivable. Along the coasts of Guinea, if a ship happens to overshoot the mouth of any river it is bound to, the current prevents its return; so that it is obliged to steer out to sea, and take a large compass, in order to correct the former mistake. These set in a contrary direction to the general motion of the sea westward; and that so strongly, that a passage which, with the current, is made in two days, is with difficulty performed in six weeks against it. However, they do not extend above twenty leagues from the coast; and ships going to the East Indies, take care not to come within the sphere of their action. At Sumatra, the currents, which are extremely rapid, run from south to north; there are also strong currents between Madagascar and the Cape of Good Hope. On the western coast of America, the currents always run from the south to the north, where a south wind, continually blowing, most probably occasions this phenomenon. But the currrents that are most remarkable, are those continually flowing into the Mediterranean sea, both from the ocean by the straits of Gibraltar, and at its other extremity, from the Euxine sea by the Archipelago. This is one of the most extraordinary appearances in nature; this large sea receiving not only the numerous rivers that fall into it, such as the Nile, the Rhone, and the Po, but also a very great influx from the Euxine sea on one part, and the ocean on the other. At the same time, it is seen to return none of those waters it is thus known to receive. Outlets running from it there are none; no rivers but such as bring it fresh supplies; no straits but what are constantly pouring their waters into it: it has, therefore, been the wonder of mankind in every age, how, and by what means, this vast concourse of waters are disposed of; or how this sea, which is always receiving, and never returning, is no way fuller than before. In order to account for this, some have said, that the water was reconveyed by subterraneous passages into the Red Sea. There is a story told of an Arabian caliph who caught a dolphin in this sea; admiring the beauty of which, he let it go again, having previously marked it by a ring of iron. Some time after a dolphin was caught in the Red sea, and quickly known by the ring to be the same that had been taken in the Mediterranean before. Such, however, as have not been willing to found their opinions upon a story, have attempted to account for the disposal of the waters of the Mediterranean by evaporation. For this purpose they have entered into long calculations upon the extent of its surface, and the quantity of water that would be raised from such a surface in a year. They then compute how much water runs in by its rivers and straits in that time; and find, that the quantity exhausted by evaporation, greatly exceeds the quantity supplied by rivers and seas. This solution, no doubt, would be satisfactory, did not the ocean, and the Euxine, evaporate as well as the Mediterranean: and as these are subject to the same drain, it must follow, that all the seas will in this respect be upon a par; and, therefore, there must be some other cause for this unperceived drain, and continual supply. This seems to be satisfactorily enough accounted for by Dr Smith, who supposes an under current running through the straits of Gibraltar, to carry out as much water into the ocean, as the upper current continually carries in from it. To confirm this, he observes, that nearer home, between the North and the South Foreland, the tide is known to run one way at top, and the ebb another way at bottom. This double current he also confirms by an experiment communicated to him by an able seaman, who being with one of the king's frigates in the Baltic, found he went with his boat into the mid-stream, and was carried violently by the current; upon which a basket was sunk, with a large cannon-ball, to a certain depth of water, which gave a check to the boat's motion: as the basket sunk still lower, the boat was driven, by the force of the water below, against the upper current; and the lower the basket was let down, the stronger the under current was found, and the quicker was the boat's motion against the upper stream, which seemed not to be above four fathom deep. From hence we may readily infer, that the same cause may operate at the straits of Gibraltar; and that while the Mediterranean seems replenishing at top, it may be emptying at bottom.[1]

---

[1] It is well known that a powerful current sets constantly from the Atlantic into the Mediterranean, and its influence extends along the whole southern borders of that sea, and even to the shores of Asia Minor. Captain Smyth found, during his survey, that the central current ran constantly at the rate of from three to

The number of the currents at sea are impossible to be recounted, nor indeed are they always known; new ones are daily produced by a variety of causes, and as quickly disappear. When a regular current is opposed by another in a narrow strait, or where the bottom of the sea is very uneven, a whirlpool is often formed. These were formerly con-

---

six miles an hour eastward into the Mediterranean, the body of water being three miles and a half wide. But there are also two lateral currents—one on the European, and one on the African side; each of them about two miles and a half broad, and flowing at about the same rate as the central stream. These lateral currents ebb and flow with the tide, setting alternately into the Mediterranean and into the Atlantic. The excess of water constantly flowing in is very great, and there is only one cause to which this can be attributed, the loss of water in the Mediterranean by evaporation. That the level of this sea should be considerably depressed by this means is quite conceivable, since we know that the winds blowing from the shores of Africa are hot and dry; and hygrometrical experiments recently made in Malta and other places, show that the mean quantity of moisture in the air investing the Mediterranean is equal only to one half of that in the atmosphere of England. The temperature also of the great inland sea is upon an average higher, by 3½° of Fahrenheit, than the western part of the Atlantic Ocean, which must greatly promote its evaporation. The Black Sea being situated in a higher latitude, and being the receptacle of rivers flowing from the north, is much colder, and its expenditure far less; accordingly, it does not draw any supply from the Mediterranean, but, on the contrary, contributes to it by a current flowing into it for the most part of the year, through the Dardanelles.

It is, however, objected, that evaporation carries away only fresh water, and that the current from the Atlantic is continually bringing in salt water: why, then, do not the component parts of the waters of the Mediterranean vary? or how can they remain so nearly the same as those of the ocean? Some have imagined that the excess of salt might be carried away by an under-current running in a contrary direction to the superior; and this hypothesis appeared to receive confirmation from a late discovery that the water taken up about fifty miles within the Straits, from a depth of 670 fathoms, contained a quantity of salt *four times greater* than the water of the surface. Dr Wollaston, who analysed this water obtained by Captain Smyth, truly inferred that an under-current of such denser water, flowing outward, if of equal breadth and depth with the current near the surface, would carry out as much salt below as is brought in above, although it moved with less than one-fourth part of the velocity, and would thus prevent a perpetual increase of saltness in the Mediterranean beyond that existing in the Atlantic. It was also remarked by others, that the result would be the same if, the swiftness being equal, the inferior current had only a fourth of the volume of the superior. At the same time there appeared reason to conclude that this great specific gravity was only acquired by water at immense depths; for two specimens of the water, taken at the distance of some hundred miles from the Straits, and at depths of 400, and even 450 fathoms, were found by Dr Wollaston not to exceed in density that of many ordinary samples of sea-water. Such being the case, we can now prove that the vast amount of salt brought into the Mediterranean *does not* pass out again by the Straits. For it appears by Captain Smyth's soundings, which Dr Wollaston had not seen, that between the Capes of Trafalgar and Spartel, which are twenty-two miles apart, and where the Straits are shallowest, the deepest part, which is on the side of Cape Spartel, is only 220 fathoms. It is therefore evident that if water sinks in certain parts of the Mediterranean in consequence of the increase of its specific gravity, to greater depths than 220 fathoms, it can never flow out again into the Atlantic, since it must be stopped by the submarine barrier which crosses the shallowest part of the Straits of Gibraltar.

The idea of the existence of a counter-current, at a certain depth, first originated in the following circumstance. M. De l'Aigle, commander of a privateer called the Phœnix, of Marseilles, gave chase to a Dutch merchant-ship, near Ceuta Point, and coming up with her in the middle of the gut, between Tariffa and Tangier, gave her one broadside, which directly sunk her. A few days after, the sunk ship, with her cargo of brandy and oil, was cast ashore near Tangier, which is at least four leagues to the westward of the place where she went down, and directly against the strength of the *central* current. This fact, however, affords no evidence of an under-current, because the ship, when it approached the coast, would necessarily be within the influence of a lateral current, which, running westward twice every twenty-four hours, might have brought back the vessel to Tangier.

What, then, becomes of the excess of salt?—for this is an inquiry of the highest geological interest. The Rhone, the Po, and many hundred minor streams and springs, pour annually into the Mediterranean large quantities of carbonate of lime, together with iron, magnesia, silica, alumina, sulphur, and other mineral ingredients, in a state of chemical solution. To explain why the influx of this matter does not alter the composition of this sea has never been regarded as a difficulty; for it is known that calcareous rocks are forming in the delta of the Rhone, in the Adriatic, on the coast of Asia Minor, and in other localities. Precipitation is acknowledged to be the means whereby the surplus mineral matter is disposed of, after the consumption of a certain portion in the secretions of testacea, zoophytes, and other marine animals. But before muriate of soda can, in like manner, be precipitated, the whole Mediterranean ought, it is said, to become as much saturated with salt as Lake Aral, the Dead Sea, or the brine-springs of Cheshire.

It is undoubtedly true, in regard to small bodies of water, that every particle must be fully saturated with muriate of soda before a single crystal of salt can be formed: such is probably the case in all natural salterns; such for example as those described by travellers as occurring on the western borders of the Black Sea, where extensive marshes are said to be covered by thin films of salt after a rapid evaporation of sea-water. The salt *étangs* of the Rhone, where salt has sometimes been precipitated in considerable abundance, have been already mentioned. But whether it be necessary that every part of a sea of enormous depth should be fully saturated before any precipitate can take place, is a question of some difficulty. In the narrowest part of the Straits of Gibraltar, where they are about nine miles broad, between the Isle of Tariffa and Alcanzar Point, the depth varies from 160 to 500 fathoms: but between Gibraltar and Ceuta, Captain Smyth sounded to the enormous depth of 950 fathoms; where he found a gravelly bottom, with fragments of broken shells. Saussure sounded to the depth of two thousand feet, within a few yards of the shore, at Nice, and M. Bérard has lately fathomed to the depth of more than six thousand feet in several places without reaching the bottom.

The central abysses of this sea are in all likelihood at least as deep as the Alps are high, and, as at the depth of seven hundred fathoms only, water has been found to contain a proportion of salt four times greater sidered as the most formidable obstructions to navigation; and the ancient poets and historians speak of them with terror; they are described as swallowing up ships, and dashing them against the rocks at the bottom; apprehension did not fail to add imaginary terrors to the description, and placed at the centre of the whirlpool a dreadful den, fraught with monsters whose howlings served to add new horrors to the dashings of the deep. Mankind at present, however, view these eddies of the sea with very little apprehension; and some have wondered how the ancients could have so much overcharged their descriptions. But all this is very naturally accounted for. In those times when navigation was in its infancy, and the slightest concussion of the waves generally sent the poor adventurer to the bottom, it is not to be wondered at that he was terrified at the violent agitations in one of these. When his little ship, but ill fitted for opposing the fury of the sea, was got within the vortex, there was then no possibility of ever returning. To add to the fatality, they were always near the shore; and along the shore was the only place where this ill-provided mariner durst venture to sail. These were, therefore, dreadful impediments to his navigation; for if he attempted to pass between them and the shore, he was sometimes sucked in by the eddy; and if he attempted to avoid them out at sea, he was often sunk by the storm. But in our time, and in our present improved state of navigation, Charybdis, and the Euripus, with all the other irregular currents of the Mediterranean, are no longer formidable. Mr Addison, not attending to this train of thinking, upon passing through the straits of Sicily, was surprised at the little there was of terror in the present appearance of Scylla and Charybdis; and seems to be of opinion, that their agitations are much diminished since the times of antiquity. In fact, from the reasons above, all the wonders of the Mediterranean sea are described in much higher colours than they merit, to us who are acquainted with the more magnificent terrors of the ocean. The Mediterranean is one of the smoothest and most gentle seas in the world; its tides are scarcely perceivable, except in the gulf of Venice, and shipwrecks are less known there than in any other part of the world.

It is in the ocean, therefore, that these whirlpools are particularly dangerous, where

---

than at the surface, we may presume that the excess of salt may be much greater at the depth of two or three miles. After evaporation, the surface water becomes impregnated with a slight excess of salt, and its specific gravity being thus increased, it instantly falls to the bottom, while lighter water rises to the top, or flows in laterally, being always supplied by rivers and the current from the Atlantic. The heavier fluid, when it arrives at the bottom, cannot stop if it can gain access to any lower part of the bed of the sea, not previously occupied by water of the same density. In this manner the bottom of the nethermost submarine abysses must annually receive new supplies of brine, while the water at the surface, being incessantly renewed by rivers and the current from the ocean, can never become saturated.

How far this accumulation of brine can extend before the inferior strata will part with any of their salt, and what difference in such a chemical process the immense pressure of the incumbent ocean might occasion, are questions which cannot be answered in the present state of science. There is also another curious topic of speculation; what changes may be effected by volcanic heat, so active in many parts of the bottom of the Mediterranean. A submarine hot-spring or stufa would give rise to a new set of phenomena. But perhaps it may be said that their effect would only be to cause ascending and descending currents, and thereby to promote the intermixture of the upper and lower waters of the sea. A solfatara, or rent through which inflammable gases are continually escaping, might certainly convert sea-water into steam; and in this case salt would be precipitated in the space from which the steam was expelled. Additional supplies of water might then find their way into the fissure, being injected into every pore of the rock by the vast pressure of the incumbent ocean. If, by a repetition of this process, the cavity was filled with salt. other crystals of the same mineral would more easily be formed from a solution, and might then spread along the bottom of the sea. Yet even in this case it should seem that the fluid must first be fully saturated with muriate of soda.

In regard to the probable origin of those continuous masses of rock-salt which we find in Poland, Hungary, Transylvania, and Spain, geologists have entertained very different opinions; but the theory which has obtained most favour in latter times attributes them not to precipitation from an aqueous menstruum, but to sublimation from volcanic exhalations rising from below, which insinuate themselves into rents and vacuities, caused by the fracture and decomposition of rocks.

The Straits of Gibraltar are said to become gradually wider by the wearing down of the cliffs on each side at many points; and the current sets along the coast of Africa so as to cause considerable inroads in various parts, particularly near Carthage. Near the Canopic mouth of the Nile, at Aboukir, the coast was greatly devastated in the year 1784, when a small island was nearly consumed. By a series of similar operations, the old sites of the cities of Nicopolis, Taposiris, Parva, and Canopus, have become a sand-bank.

It frequently happens, where the sea is encroaching on a coast, that perpendicular cliffs of considerable height, composed of loose sand, supply, as they crumble away, large quantities of fine sand, which being in mid-air when detached, are carried by the winds to great distances, covering the land or barring up the mouths of estuaries. This is exemplified in Poole Bay, in Hampshire, and in many points of the coast of Norfolk and Suffolk. But a violent wind will sometimes drift the sand of a sea beach, and carry it up with fragments of shells to great heights, as in the case of the sands of Barry, at the northern side of the estuary of the Tay, where hills of this origin attain the height of 140 feet.

On the coast of France and Holland long chains of these dunes have been formed in many parts, and often give rise to very important geologica changes, by damming up the mouths of estuaries, and preventing the free ingress of the tides, or free efflux of river water.—*Lyell's Geology.*

the tides are violent, and the tempests fierce. To mention only one, that called *the Maelstroom*, upon the coasts of Norway, which is considered as the most dreadful and voracious in the world. The name it has received from the natives, signifies *the navel of the sea;* since they suppose that a great share of the water of the sea is sucked up and discharged by its vortex. A minute description of the internal parts is not to be expected, since none who were there ever returned to bring back information. The body of the waters that form this whirlpool, are extended in a circle above thirteen miles in circumference.[1] In the midst of this stands a rock, against which the tide in its ebb is dashed with inconceivable fury. At this time it instantly swallows up all things that come within the sphere of its violence, trees, timber, and shipping. No skill in the mariner, nor strength of rowing, can work an escape: the sailor at the helm finds the ship at first go in a current opposite to his intentions; his vessel's motion, though slow in the beginning, becomes every moment more rapid; it goes round in circles still narrower, and narrower, till at last it is dashed against the rocks, and instantly disappears: nor is it seen again for six hours; till the tide flowing, it is vomited forth with the same violence with which it was drawn in. The noise of this dreadful vortex still farther contributes to increase its terror, which, with the dashing of the waters, and the dreadful valley, if it may be so called, caused by their circulation, makes one of the most tremendous objects in nature.

CHAP. XVII.

OF THE CHANGES PRODUCED BY THE SEA UPON THE EARTH.[2]

From what has been said, as well of the earth as of the sea, they both appear to be in continual fluctuation. The earth, the common promptuary that supplies subsistence to men, animals, and vegetables, is continually furnishing its stores to their support. But the matter which is thus derived from it, is soon restored, and laid down again to be prepared for fresh mutations. The transmigration of souls is, no doubt, false and whimsical; but nothing can be more certain than the transmigration of bodies; the spoils of the meanest reptile may go to the formation of a prince; and, on the contrary, as the poet has it, the body of Cæsar may be employed in stopping a beer-barrel. From this, and other causes, therefore, the earth is in continual change. Its internal fires, the deviation of its rivers, and the falling of its mountains, are daily altering its surface; and geography can scarcely recollect the lakes and the valleys that history once described.

But these changes are nothing to the instability of the ocean. It would seem that inquietude was as natural to it as its fluidity. It is first seen with a constant and equable motion going towards the west; the tides then interrupt this progression, and for a time drive the waters in a contrary direction: besides these agitations, the currents act their part in a smaller sphere, being generally greatest where the other motions of the sea are least; namely, nearest the shore; the winds also contribute their share in this universal fluctuation; so that scarcely any part of the sea is wholly seen to stagnate.

Nil enim quiescit, undis impellitur unda,
Et spiritus et calor toto se corpore miscent.

As this great element is thus changed, and continually labouring internally, it may be readily supposed that it produces correspondent changes upon its shores, and those parts of the earth subject to its influence. In fact, it is every day making considerable alterations, either by overflowing its shores in one place, or deserting them in others; by covering over whole tracts of country that were cultivated and peopled, at one time; or by leaving its bed to be appropriated to the purposes of vegetation, and to supply a new theatre for human industry, at another.

In this struggle between the earth and the sea for dominion, the greatest number of our shores seem to defy the whole rage of the waves, both by their height, and the rocky materials of which they are composed. The coasts, of Italy, for instance, are bordered with rocks of marble of different kinds, the quarries of which may easily be distinguished at a distance from sea, and appear like perpendicular columns of the most beautiful kinds of marble, ranged along the shore. In general, the coasts of France, from Brest to Bourdeaux, are composed of rocks:[3] as are also those of Spain and England, which defend the land, and only are interrupted, here and there, to give an egress to rivers, and to grant the conveniences of bays and harbours to our shipping. It may in general be remarked, that wherever the sea is most violent and furious, there the boldest shores, and of the most compact materials, are found to oppose it. There are many shores several hundred feet perpendicular, against which the sea, when swollen with tides or storms, rises and beats with inconceivable fury. In the Orkneys,[1] where the shores are thus formed, it sometimes, when agitated by a storm, rises two hundred feet perpendicular, and dashes up its spray, together with sand and other substances that compose its bottom, upon land, like showers of rain.

---

[1] Kircher, Mund. Subt. vol i. p. 156.

[2] Some of these changes are described in the geological Notes to a preceding chapter.

[3] Buffon, vol. ii. p. 199

From hence, therefore, we may conceive how the violence of the sea, and the boldness of the shore, may be said to have made each other. Where the sea meets no obstacles, it spreads its waters with a gentle intumescence, till all its power is destroyed, by wanting depth to aid the motion. But when its progress is checked in the midst, by the prominence of rocks, or the abrupt elevation of the land, it dashes with all the force of its depth against the obstacle, and forms, by its repeated violence, that abruptness of the shore which confines its impetuosity. Where the sea is extremely deep, or very much vexed by tempests, it is no small obstacle that can confine its rage; and for this reason we see the boldest shores projected against the deepest waters; all less impediments having long since been surmounted and washed away. Perhaps of all the shores in the world, there is not one so high as that on the west of St Kilda, which, upon a late admeasurement,[2] was found to be six hundred fathoms perpendicular above the surface of the sea. Here also, the sea is deep, turbulent, and stormy; so that it requires great force in the shore to oppose its violence. In many parts of the world, and particularly upon the coasts of the East Indies, the shores, though not high above water, are generally very deep, and consequently the waves roll against the land with great weight and irregularity. This rising of the waves against the shore, is called by mariners *the surf of the sea;* and in shipwrecks is generally fatal to such as attempt to swim on shore. In this case no dexterity in the swimmer, no float he can use, neither swimming-girdle nor cork-jacket, will save him; the weight of the superincumbent waves breaks upon him at once, and crushes him with certain ruin. Some few of the natives, however, have the art of swimming and of navigating their little boats near those shores, where an European is sure of instant destruction.

In places where the force of the sea is less violent, or its tides less rapid, the shores are generally seen to descend with a more gradual declivity. Over these, the waters of the tide steal by almost imperceptible degrees, covering them for a large extent, and leaving them bare on its recess. Upon these shores, as was said, the sea seldom beats with any great violence, as a large wave has not depth sufficient to float it onwards, so that here only are to be seen gentle surges making calmly towards land, and lessening as they approach. As the sea, in the former description, is generally seen to present prospects of tumult and uproar, here it more usually exhibits a scene of repose and tranquil beauty. Its waters which, when surveyed from the precipice, afforded a muddy greenish hue, arising from their depth and position to the eye,[3] when regarded from a shelving shore, wear the colour of the sky, and seem rising to meet it. The deafening noise of the deep sea, is here converted into gentle murmurs; instead of the waters dashing against the face of the rock, it advances and recedes, still going forward, but with just force enough to push its weeds and shells, by insensible approaches, to the shore.

There are other shores, beside those already described, which either have been raised by art, to oppose the sea's approaches, or, from the sea's gaining ground, are threatened with imminent destruction. The sea's being thus seen to give and take away lands at pleasure, is, without question, one of the most extraordinary considerations in all natural history. In some places it is seen to obtain the superiority by slow and certain approaches; or to burst in at once, and overwhelm all things in undistinguished destruction; in other places it departs from its shores, and where its waters have been known to rage, it leaves fields covered with the most beautiful verdure.

The formation of new lands by the sea's continually bringing its sediment to one place, and by the accumulation of its sands in another, is easily conceived. We have had many instances of this in England.[4] The island of Oxney, which is adjacent to Romney-marsh, was produced in this manner. This had for a long time been a low level, continually in danger of being over-flown by the river Rother; but the sea, by its depositions, has gradually raised the bottom of the river, while it has hollowed the mouth; so that the one is sufficiently secured from inundations, and the other is deep enough to admit ships of considerable burden. The like also may be seen at that bank called the *Dogger-sands*, where two tides meet, and which thus receives new increase every day, so that in time the place seems to promise fair for being habitable earth. On many parts of the coasts of France, England, Holland, Germany, and

---

[1] Buffon, p. 191.

[2] Description of St Kilda.

[3] Newton's Optics, p. 163—167.

[4] It is supposed that there existed an isthmus between Great Britain and France, which is conceived to have been broken down by the sea, before the commencement of any accurate historical records respecting these islands.

Prussia, the sea has been sensibly known to retire.[1] Hubert Thomas asserts, in his description of the Country of Liege, that the sea formerly encompassed the city of Tongres, which, however, is at present thirty-five leagues distant from it: this assertion he supports by many strong reasons; and, among others, by the iron rings fixed in the walls of the town, for fastening the ships that came into the port. In Italy there is a considerable piece of ground gained at the mouth of the river Arno; and Ravenna, that once stood by the sea-side, is now considerably removed from it. But we need scarcely mention these, when we find that the whole republic of Holland seems to be a conquest upon the sea, and in a manner rescued from its bosom.[2] The surface of the earth, in this country, is below the level of the bed of the sea; and I remember, upon approaching the coast, to have looked down upon it from the sea, as into a valley: however, it is every day rising higher by the depositions made upon it by the sea, the Rhine, and the Meuse; and those parts which formerly admitted large men of war, are now known to be too shallow to receive ships of very moderate burthen. The province of Jucatan, a peninsula in the gulf of Mexico, was formerly a part of the sea. This tract, which stretches out into the ocean a hundred leagues, and which is above thirty broad, is every where, at a moderate depth below the surface, composed of shells, which evince that its land once formed the bed of the sea. In France, the town of Aiges Mortes was a port in the times of St Louis, which is now removed more than four miles from the sea. Psalmodi, in the same kingdom, was an island in the year 815, but is now more than six miles from the shore. All along the coasts of Norfolk, I am very well assured, that in the memory of man the sea has gained fifty yards in some places, and has lost as much in others.

Thus numerous, therefore, are the instances of new lands having been produced from the sea, which, as we see, is brought about two different ways; first, by the waters raising banks of sand and mud where their sediment is deposited; and, secondly, by their relinquishing the shore entirely, and leaving it unoccupied to the industry of man.

But as the sea has been thus known to recede from some lands, so has it, by fatal experience, been found to encroach upon others; and probably these depredations on one part of the shore, may account for their dereliction from another; for the current which rested upon some certain bank having got an egress in some other place, it no longer presses upon its former bed, but pours all its stream into the new entrance; so that every inundation of the sea may be attended with some correspondent dereliction of another shore.

---

[1] Buffon, vol. vi. p. 424.

[2] *Inroads of the sea in Holland.*—One of the most memorable irruptions occurred in 1421, where the tide, pouring into the mouth of the united Meuse and Waal, burst through a dam in the district named Bergse-Veld, and overflowed twenty-two villages, forming that large sheet of water called the Bies Bosch. No vestige even of the ruins of these places could ever afterwards be seen, but a small portion of the new bay became afterwards silted up, and formed an island. The Leck, or central arm of the Rhine, which enters the sea a little to the north of this new estuary, has, at present, a communication with it. The island Grunewert, which in the year 1228 existed not far from Houten, has been entirely destroyed. Farther to the north is a long line of shore covered with sand dumes, where great depredations have been made from time to time. The church of Scheveningen, not far from the Hague, was once in the middle of the village, and now stands on the shore; half the place having been overwhelmed by the waves in 1570. Catwyck, once far from the sea, is now upon the shore; two of its streets having been overflowed, and land torn away to the extent of two hundred yards in 1719. It is only by aid of embankments, that Petten, and several other places farther north, have been defended against the sea.

Still more important are the changes which have taken place on the coast opposite the right arm of the Rhine, or the Yssel, where the ocean has burst through a large isthmus, and entered the inland lake Flevo, which, in ancient times, was, according to Pomponius Mela, formed by the overflowing of the Rhine over certain low lands. It appears that, in the time of Tacitus, there were several lakes in the present site of the Zuyder Zee, between Friesland and Holland. The successive inroads by which these, and a great part of the adjoining territory, were transformed into a great gulf, began about the commencement, and were completed towards the close of the thirteenth century. Alting gives the following relation of the occurrence, drawn from manuscript documents of contemporary inhabitants of the neighbouring provinces. In the year 1205, the island now called Wieringen, to the south of the Texel, was still a part of the mainland, but during several high floods, of which the dates are given, ending in December, 1251, it was separated from the continent. By subsequent incursions, the sea consumed great parts of the rich and populous isthmus, a low tract which stretched on the north of Lake Flevo, between Staveren in Friesland, and Medemblick in Holland, till at length a breach was completed about the year 1282, and afterwards widened. Great destruction of land took place when the sea first broke in, and many towns were swept away; but there was afterwards a reaction to a certain extent, large tracts at first submerged having been gradually redeemed. The new straits south of Staveren are more than half the width of those of Dover, but are very shallow, the greatest depth not exceeding two or three fathoms. The new bay is of a somewhat circular form, and between *thirty* and *forty* miles in diameter. How much of this space may formerly have been occupied by Lake Flevo, is unknown.

A series of isles, stretching from the Texel to the mouths of the Weser and Elbe, are evidently the last relics of a tract once continuous. They have greatly diminished in size, and have lost about a third of their number since the time of Pliny; for that naturalist counted twenty-three islands between the Texel and Eidor, whereas there are now only sixteen, including Heligoland and Neuwerk. Heligoland, at the mouth of the Elbe, began in the year 800 to be much consumed by the waves. In the years 1300, 1500, and 1649, other parts were swept away, till at last only a rock and some low ground remained. Since 1770, a current has cut a passage sufficiently deep to admit large ships through this remaining portion, and has formed two islands. On the other hand some few islands have extended their bounds in one direction, or become connected with others, by the sanding-up of channels; but even these, like Juist, have generally given way as much on the north towards the sea as they have gained on the south, or land side.—*Lyell's Geology.*

However this be, we have numerous histories of the sea's inundations, and its burying whole provinces in its bosom. Many countries that have been thus destroyed, bear melancholy witness to the truth of history; and show the tops of their houses, and the spires of their steeples, still standing at the bottom of the water. One of the most considerable inundations we have in history, is that which happened in the reign of Henry I. which overflowed the estates of the Earl Godwin, and forms now that Bank called the Godwin Sands. In the year 1546, a similar irruption of the sea destroyed a hundred thousand persons in the territory of Dort; and yet a greater number round Dullart. In Friezland, and Zealand, there were more than three hundred villages overwhelmed; and their ruins continue still visible at the bottom of the water in a clear day. The Baltic sea has, by slow degrees, covered a large part of Pomerania; and, among others, destroyed and overwhelmed the famous port of Vineta. In the same manner, the Norwegian sea has formed several little islands from the main land, and still daily advances upon the continent. The German sea has advanced upon the shores of Holland, near Catt; so that the ruins of an ancient citadel of the Romans, which was formerly built upon this coast, are now actually under water. To these accidents several more might be added; our own historians, and those of other countries, abound with them; almost every flat shore of any extent, being able to show something that it has lost, or something that it has gained from the sea.

There are some shores on which the sea has made temporary depredations; where it has overflowed, and after remaining perhaps some ages, it has again retired of its own accord, or been driven back by the industry of man.[1] There are many lands in Norway, Scotland, and the Maldive Islands, that are at one time covered with water, and at another free. The country round the isle of Ely, in the times of Bede, about a thousand years ago, was one of the most delightful spots in the whole kingdom; it was not only richly cultivated, and produced all the necessaries of life, but grapes also, that afforded excellent wine. The accounts of that time are copious in the description of its verdure and fertility; its rich pastures covered with flowers and herbage; its beautiful shades, and wholesome air. But the sea, breaking in upon the land, overwhelmed the whole country, took possession of the soil, and totally destroyed one of the most fertile valleys in the world. Its air, from being dry and healthful, from that time became most unwholesome, and clogged with vapours; and the small part of the country that, by being higher than the rest, escaped the deluge, was soon rendered uninhabitable, from its noxious vapours. Thus this country continued under water for some centuries: till at last the sea, by the same caprice which had prompted its invasions, began to abandon the earth in like manner. It has continued for some ages to relinquish its former conquests; and although the inhabitants can neither boast the longevity nor the luxuries of their former pre-occupants, yet they find ample means of subsistence; and if they happen to survive the first years of their residence there, they are often known to arrive at a good old age.

But although history be silent as to many other inundations of the like kind, where the sea has overflowed the country, and afterwards retired, yet we have numberless testimonies of another nature, that prove it beyond the possibility of a doubt: I mean those numerous trees that are found buried at considerable depths in places where either rivers or the sea have accidentally overflown.[2] At the mouth of the river Ness, near Bruges, in Flanders, at the depth of fifty feet, are found great quantities of trees lying as close to each other as they do in a wood; the trunks, the branches, and the leaves, are in such perfect preservation, that the particular kind of each tree may instantly be known. About five hundred years ago, this very ground was known to have been covered by the sea: nor is there any history or tradition of its having been dry ground, which we can have no doubt must have been the case. Thus we see a country flourishing in verdure, producing large forests, and trees of various kinds, overwhelmed by the sea. We see this element depositing its sediment to a height of fifty feet; and its waters must, therefore, have risen much higher. We see the same, after it has thus overwhelmed and sunk the land so deep beneath its slime, capriciously retiring from the same coasts, and leaving that habitable once more, which it had formerly destroyed. All this is wonderful; and perhaps, instead of attempting to inquire after the cause, which has hitherto been inscrutable, it will best become us to rest satisfied with admiration.

---

[1] Buffon, vol. ii. p. 425.

[2] Buffon, vol. ii. p. 403.

At the city of Modena in Italy, and about four miles round it, wherever it is dug, when the workmen arrive at the depth of sixty-three feet, they come to a bed of chalk, which they bore with an auger five feet deep: they then withdraw from the pit, before the auger is removed, and upon its extraction, the water bursts up through the aperture with great violence, and quickly fills this new-made well, which continues full, and is affected neither by rains nor droughts. But that which is most remarkable in this operation, is the layers of earth as we descend. At the depth of fourteen feet are found the ruins of an ancient city, paved streets, houses, floors, and different pieces of Mosaic. Under this is found a solid earth, that would induce one to think had never been removed; however, under it is found a soft oozy earth, made up of vegetables; and at twenty-six feet depth, large trees entire, such as walnut-trees, with the walnuts still sticking on the stem, and their leaves and branches in exact preservation. At twenty-eight feet depth, a soft chalk is found mixed with a vast quantity of shells; and this bed is eleven feet thick. Under this, vegetables are found again, with leaves, and branches of trees as before; and thus alternately chalk and vegetable earth to the depth of sixty-three feet. These are the layers wherever the workmen attempt to bore; while in many of them they also find pieces of charcoal, bones, and bits of iron. From this description, therefore, it appears, that this country has been alternately overflowed and deserted by the sea, one age after another: nor were these overflowings and retirings of trifling depth, or of short continuance. When the sea burst in, it must have been a long time in overwhelming the branches of the fallen forest with its sediment; and still longer in forming a regular bed of shells eleven feet over them. It must have, therefore, taken an age, at least, to make any one of these layers; and we may conclude, that it must have been many ages employed in the production of them all. The land also, upon being deserted, must have had time to grow compact, to gather fresh fertility, and to be drained of its waters before it could be disposed to vegetation, or before its trees could have shot forth again to maturity.

We have instances nearer home of the same kind given us in the Philosophical Transactions; one of them by Mr Derham. An inundation of the sea, at Dagenham, in Essex, laying bare a part of the adjacent pasture for above two hundred feet wide, and, in some places, twenty deep, it discovered a number of trees that had lain there for many ages before: these trees, by lying long under ground, were become black and hard, and their fibres so tough, that one might as easily break a wire, as any of them: they lay so thick in the place where they were found, that in many parts he could step from one to another: he conceived also, that not only all the adjacent marshes, for several hundred acres, were covered underneath with such timber, but also the marshes along the mouth of the Thames, for several miles. The meeting with these trees at such depths, he ascribes to the sediment of the river, and the tides, which constantly washing over them, have always left some part of their substance behind, so as, by repeated alluvions, to work a bed of vegetable earth over them, to the height at which he found it.[1]

---

[1] Many writers have declared that the gain on our eastern coast, since the earliest periods of history, has more than counterbalanced the loss; but they have been at no pains to calculate the amount of loss, and have often forgotten that, while the new acquisitions are manifest, there are rarely any natural monuments to attest the former existence of the land that has been carried away. They have also taken into their account those tracts artificially recovered, which are often of great agricultural importance, and may remain secure, perhaps, for thousands of years, but which are only a few feet above the mean level of the sea, and are therefore exposed to be overflowed again by a small proportion of the force required to remove cliffs of considerable height on our shores. If it were true that the area of land annually abandoned by the sea in estuaries were equal to that invaded by it, there would still be no compensation *in kind*.

It will seem, at first sight, somewhat paradoxical, but it is nevertheless true, that the greater number of estuaries, although peculiarly exposed to the invasion of the sea, are usually contracting in size, even where the whole line of coast is giving way. But the fact is, that the inroads made by the ocean upon estuaries, although extremely great, are completed during periods of comparatively short duration; and in the intervals between these irruptions, the mouths of rivers, like other parts of the coast, usually enjoy a more or less perfect respite. All the estuaries, taken together, constitute but a small part of a great line of coast; it is, therefore, most probable, that if our observations extend to a few centuries only, we shall not see any, and very rarely all, of this small part exposed to the fury of the ocean. The coast of Holland and Friezland, if studied for several consecutive centuries since the Roman era, would generally have led to the conclusion that the land was encroaching fast upon the sea, and that the aggrandizement within the estuaries far more than compensated the losses on the open coast. But when our retrospect embraces the whole period, an opposite inference is drawn; and we find that the Zuyder Zee, the Bies Bosch, Dollurt, and Yahde, are modern gulfs and bays, and that these points have been the principal theatres of the retreat, instead of the advance, of the land. If we possessed records of the changes on our coast for several thousand years, they would probably present us with similar results; and although we have hitherto seen our estuaries, for the most part, become partially converted into dry land, and portions of bold cliffs intervening between the mouths of rivers consumed by the sea, this has merely arisen from the accidental set of the currents and tides during a brief period.

The current which flows round from the north-west. and bears against our eastern coast, transports, as we

The levels of Hatfield-Chace, in Yorkshire, a tract of above eighteen thousand acres, which was yearly overflown, was reduced to arable and pasture-land, by one Sir Cornelius Vermusden, a Dutchman. At the bottom of this wide extent, are found millions of the roots and bodies of trees, of such as this island either formerly did, or does at present, produce. The roots of all stand in their proper postures; and by them, as thick as ever they could grow, the respective trunks of each, some above thirty yards long. The oaks, some of which have been sold for fifteen pounds a-piece, are as black as ebony, very lasting, and close-grained. The ash-trees are as soft as earth, and are commonly cut in pieces by the workmen's spades, and as soon as flung up into the open air, turn to dust. But all the rest, even the willows themselves, which are softer than the ash, preserve their substance and texture to this very day. Some of the firs appear to have vegetated, even after they were fallen, and to have, from their branches, struck up large trees, as great as the parent trunk. It is observable, that many of these trees have been burnt, some quite through, some on one side, some have been found chopped and squared, others riven with great wooden wedges; all sufficiently manifesting, that the country which was deluged had formerly been inhabited. Near a great root of one tree, was found eight coins of the Roman emperors; and, in some places, the marks of the ridge and furrow were plainly perceivable, which testified that the ground had formerly been patient of cultivation.

The learned naturalist who has given this description,[1] has pretty plainly evinced, that this forest in particular, must have been thus levelled by the Romans; and that the falling of the trees must have contributed to the accumulation of the waters. "The Romans," says he, "when the Britons fled, always pursued them into the fortresses of low woods, and miry forests: in these the wild natives found shelter; and when opportunity offered, issued out and fell upon their invaders without mercy. In this manner the Romans were at length so harrassed, that orders were issued out for cutting down all the woods and forests in Britain. In order to effect this, and destroy the enemy the easier, they set fire to the woods, composed of pines and other inflammable timber, which spreading, the conflagration destroyed not only the forest, but infinite numbers of the wretched inhabitants who had taken shelter therein. When the pine trees had thus done what mischief they could, the Romans then brought their army nearer, and, with whole legions of the captive Britons, cut down most of the trees that were yet left standing; leaving only here and there some great trees untouched, as monuments of their fury. These, unneedful of their labour, being des-

---

have seen, materials of various kinds. It undermines and sweeps away the granite, gneiss, trap rocks, and sandstone of Shetland, and removes the gravel and loam of the cliffs of Holderness, Norfolk, and Suffolk, which are between fifty and two hundred feet in height, and which waste at the rate of from one to six yards annually. It bears away the strata of London clay on the coast of Essex and Sheppey—consumes the chalk with its flints many miles continuously on the shores of Kent and Sussex—commits annual ravages on the fresh-water beds, capped by a thick covering of chalk flints in Hampshire, and continually saps the foundations of the Portland limestone. It receives, besides, during the rainy months, large supplies of pebbles, sand, and mud, which numerous streams from the Grampians, Cheviots, and other chains, send down to the sea. To what regions, then, is all this matter consigned? It is not retained in mechanical suspension by the waters of the sea, nor does it mix with them in a state of chemical solution,—it is deposited *somewhere*, yet certainly not in the immediate neighbourhood of our shores; for, in that case, there would soon be a cessation of the encroachment of the sea, and large tracts of low land, like Romney Marsh, would almost every where encircle our island. As there is now a depth of water, exceeding thirty feet, in some spots where cities flourished but a few centuries ago, it is clear that the current not only carries far away the materials of the wasted cliffs, but tears up besides many of the regular strata at the bottom of the sea.

So great is the quantity of matter held in suspension by the tidal current on our shores, that the waters are in some places artificially introduced into certain lands below the level of the sea; and by repeating this operation, which is called "warping," for two or three years, considerable tracts have been raised, in the estuary of the Humber, to the height of about six feet. Large quantities of coarse sand and pebbles are also drifted along at the bottom: and when such a current meets with any deep depression in the bed of the ocean, it must necessarily fill it up; just as a river, when it meets with a lake in its course, fills it gradually with sediment. But in the one case, the sheet of water is converted into land; whereas, in the other, a shoal only will be raised, overflowed at high water, or at least by spring tides. The only records which we at present possess of the gradual shallowing of seas are confined, as might be expected, to estuaries, havens, and certain channels of no great depth; and to some inland seas, as the Baltic, Adriatic, and Arabian gulf. It is only of late years that accurate surveys and soundings have afforded data of comparison in very deep seas, of which future geologists will avail themselves.

An extraordinary gain of land is described to have taken place at the head of the Red sea, the isthmus of Suez having doubled in breadth since the age of Herodotus. In his time, and down to that of Arrian, Heroopolis was on the coast, now it is as far distant from the Red sea as from the Mediterranean. Suez in 1541 received into its harbour the fleet of Solyman II.; but it is now changed into a sand-bank. The country called Tehama on the Arabian side of the Gulf has increased from three to six miles since the Christian era. Inland from the present ports are the ruins of more ancient towns, which were once on the sea-shore, and bore the same names. It is said that the blown sand from the deserts supplies some part of the materials of this new land, and that the rest is composed of shells and corals, of which the growth is very rapid.—*Lyell's Geology.*

[1] Phil. Trans. vol. iv. part ii. p. 214.

titute of the support of the underwood, and of their neighbouring trees, were easily overthrown by the winds, and, without interruption, remained on the places where they happened to fall. The forest, thus fallen, must necessarily have stopped up the currents, both from land and sea; and turned into great lakes, what were before but temporary streams. The working of the waters here, the consumption and decay of rotten boughs and branches, and the vast increase of water-moss which flourishes upon marshy grounds, soon formed a covering over the trunks of the fallen trees, and raised the earth several feet above its former level. The earth thus every day swelling, by a continual increase from the sediment of the waters, and by the lightness of the vegetable substances of which it was composed, soon overtopt the waters by which this intumescence was at first effected; so that it entirely got rid of its inundations, or only demanded a slight assistance from man for that purpose." This may be the origin of all bogs, which are formed by the putrefaction of vegetable substances, mixed with the mud and slime deposited by waters, and at length acquiring a sufficient consistency.

From this we see what powerful effects the sea is capable of producing upon its shores, either by overflowing some, or deserting others; by altering the direction of these, and rendering those craggy and precipitate, which before were shelving. But the influence it has upon these, is nothing to that which it has upon that great body of earth which forms its bottom. It is at the bottom of the sea that the greatest wonders are performed, and the most rapid changes are produced; it is there that the motion of the tides and the currents have their whole force, and agitate the substances of which their bed is composed. But all these are almost wholly hid from human curiosity: the miracles of the deep are performed in secret; and we have but little information from its abysses, except what we receive by inspection at very shallow depths, or by the plummet, or from divers, who are known to descend from twenty to thirty fathoms.[1]

The eye can reach but a very short way into the depths of the sea; and that only when its surface is glassy and serene. In many seas it perceives nothing but a bright sandy plain at bottom, extending for several hundred miles, without an intervening object. But in others, particularly in the Red sea, it is very different: the whole bottom of this extensive bed of waters is, literally speaking, a forest of submarine plants and corals, formed by insects for their habitation, sometimes branching out to a great extent. Here are seen the madrepores, the sponges, mosses, sea-mushrooms, and other marine productions, covering every part of the bottom; so that some have even supposed the sea to have taken its name from the colour of its plants below. However, these plants are by no means peculiar to this sea, as they are found in great quantities in the Persian gulf, along the coast of Africa, and those of Provence and Catalonia.

The bottom of many parts of the sea, near America, presents a very different, though a very beautiful, appearance. This is covered with vegetables, which make it look as green as a meadow, and beneath are seen thousands of turtles, and other sea-animals feeding thereon.

In order to extend our knowledge of the sea to greater depths, recourse has been had to the plummet; which is generally made of a lump of lead of about forty pounds weight, fastened to a cord.[2] This, however, only answers in moderate depths; for when a deep sea is to be sounded, the matter of which the cord is composed, being lighter than the water, floats upon it, and when let down to a considerable depth, its length so increases its surface, that it is often sufficient to prevent the lead from sinking; so that this may be the reason why some parts of the sea are said to have no bottom.

In general, we learn from the plummet, that the bottom of the sea is tolerably even where it has been examined; and that the farther from the shore, the sea is in general the deeper. Notwithstanding, in the midst of a great and unfathomable ocean, we often find an island raising its head, and singly braving its fury. Such islands may be considered as the mountains of the deep; and, could we for a moment imagine the waters of the ocean removed or dried away, we should probably find the inequalities of its bed resembling those that are found at land. Here extensive plains, there valleys, and, in many places, mountains of amazing height. M. Bauche has actually given us a map of that part of its bottom, which lie between Africa and America, taken from the several soundings of mariners: in it we find the same uneven surface that we do upon land, the same eminences, and the same depressions. In such an imaginary prospect, however, there would be this difference, that as the tops of land-mountains appear the most barren and rocky, the tops of sea-mountains would be found the most verdant and fruitful.

The plummet, which thus gives us some idea of the inequalities of the bottom, leaves us totally in the dark as to every other particular; recourse, therefore, has been had to divers: these, either being bred up in this dangerous way of life, and accustomed to remain sometime under water without breathing, or assisted by means of a diving-bell, have been able to return some confused and uncertain accounts of the places below. In the great diving-bell improved by Dr Halley, which was large enough to contain five men, and was supplied with fresh air by buckets, that alternately rose and fell, they descended fifty fathom. In this huge machine, which was let down from the mast of the ship, the doctor himself went down to the bottom, where, when the sea was clear, and especially when the sun shone, he could see perfectly well to write or read, and much more to take up any thing that was underneath: at other times, when the water was troubled and thick, it was dark as night below, so that he was obliged to keep a candle lighted at the bottom. But there is one thing very remarkable, that the water which from above was usually seen of a green colour, when looked at from below, appeared to him of a very different one, casting a redness upon one of his hands, like that of damask roses:[1]—a proof of the sea's taking its colour not from any thing floating in it, but from the different reflections of the rays of light. Upon the whole, the accounts we have received from the bottom, by this contrivance, are but few. We learn from it, and from divers in general, that while the surface of the sea may be deformed by tempests, it is usually calm and temperate below;[2] that some divers, who have gone down when the weather was calm, and came up when it was tempestuous, were surprised at their not perceiving the change at the bottom. This, however, must not be supposed to obtain with regard to the tides, and the currents, as they are seen constantly shifting their bottom; taking their bed with great violence from one place, and depositing it upon another. We are informed, also, by divers, that the sea grows colder in proportion as they descend to the bottom; that as far as the sun's rays pierce, it is influenced by their warmth; but lower, the cold becomes almost intolerable. A person of quality, who had been himself a diver, as Mr Boyle informs us, declared, that though he seldom descended above three or four fathoms, yet he found it so much colder than near the top, that he could not well endure it; and that being let down in a great diving-bell, although the water could not immediately touch him, he found the air extremely cold upon his first arrival at the bottom.

---

[1] Phil. Trans. vol. iv. part ii. p. 192.

[2] Boyle, vol. ii. p. 5.

From divers also we learn that the sea, in many places, is filled with rocks at bottom; and that among their clefts, and upon their sides, various substances sprout forward, which are either really vegetables, or the nests of insects, increased to some magnitude. Some of these assume the shape of beautiful flowers; and, though soft when taken up, soon harden, and are kept in the cabinets of the curious.

But of all those divers who have brought us information from the bottom of the deep, the famous Nicola Pesce, whose performances are told us by Kircher, is the most celebrated. I will not so much as pretend to vouch for the veracity of Kircher's account, which he assures us he had from the archives of the kings of Sicily; but it may serve to enliven a heavy chapter. "In the times of Frederic, king of Sicily, there lived a celebrated diver, whose name was Nicholas, and who, from his amazing skill in swimming, and his perseverance under water, was surnamed the *Fish*. This man had from his infancy been used to the sea; and earned his scanty subsistence by diving for corals and oysters; which he sold to the villagers on shore. His long acquaintance with the sea, at last brought it to be almost his natural element. He frequently was known to spend five days in the midst of the waves, without any other provisions than the fish which he caught there, and eat raw. He often swam over from Sicily to Calabria, a tempestuous and dangerous passage, carrying letters from the king. He was frequently known to swim among the gulfs of the Lipari islands, no way apprehensive of danger.

"Some mariners out at sea, one day observed something at some distance from them which they regarded as a sea monster; but, upon its approach, it was known to be Nicholas, whom they took into their ship. When they asked him whither he was going in so stormy and rough a sea, and at such a distance from land, he showed them a packet of letters, which he was carrying to one of the towns of Italy exactly done up in a leather bag, in such a manner as that they could not be wetted by the sea. He kept them thus company for some time on their voyage, conversing and asking questions; and after eating a hearty meal with them, he took his leave, and jumping into the sea, pursued his voyage alone.

"In order to aid these powers of enduring in the deep, nature seemed to have assisted him in a very extraordinary manner; for the spaces between his fingers and toes were webbed as in a goose; and his chest became so very capacious, that he could take in at one inspiration, as much breath as would serve him for a whole day.

"The account of so extraordinary a person did not fail to reach the king himself, who, actuated by the general curiosity, ordered that

---

[1] Newton's Optics. p. 56. [2] Boyle, vol. iii. 242.

Nicholas should be brought before him. It was no easy matter to find Nicholas, who generally spent his time in the solitudes of the deep; but at last, however, after much searching, he was found, and brought before his majesty. The curiosity of this monarch had been long excited by the accounts he had heard of the bottom of the gulf of Charybdis; he therefore conceived that it would be a proper opportunity to have more certain information; and commanded our poor diver to examine the bottom of this dreadful whirlpool; as an excitement to his obedience, he ordered a golden cup to be flung into it. Nicholas was not insensible of the danger to which he was exposed: dangers best known only to himself; and he therefore presumed to remonstrate; but the hopes of the reward, the desire of pleasing the king, and the pleasure of showing his skill, at last prevailed. He instantly jumped into the gulf, and was swallowed as instantly up in its bosom. He continued for three quarters of an hour below; during which time the king and his attendants remained upon shore anxious for his fate; but he at last appeared, buffeting upon the surface, holding the cup in triumph in one hand, and making his way good among the waves with the other. It may be supposed he was received with applause, upon his arrival on shore; the cup was made the reward of his adventure; the king ordered him to be taken proper care of; and, as he was somewhat fatigued and debilitated by his labour, after a hearty meal he was put to bed, and permitted to refresh himself by sleeping.

"When his spirits were thus restored, he was again brought to satisfy the king's curiosity with a narrative of the wonders he had seen; and his account was to the following effect:—He would never, he said, have obeyed the king's commands, had he been apprised of half the dangers that were before him. There were four things, he said, that rendered the gulf dreadful, not only to men, but even to the fishes themselves: first, the force of the water bursting up from the bottom, which requires great strength to resist; secondly, the abruptness of the rocks, that on every side threatened destruction; thirdly, the force of the whirlpool, dashing against those rocks; and fourthly, the number and magnitude of the polypus fish, some of which appeared as large as a man, and which every where sticking against the rocks, projected their fibrous arms to entangle him. Being asked how he was able so readily to find the cup that had been thrown in, he replied that it happened to be flung by the waves into the cavity of a rock, against which he himself was urged in his descent. This account, however, did not satisfy the king's curiosity; being requested to venture once more into the gulf for further discoveries, he at first refused; but the king, desirous of having the most exact information possible of all things to be found in the gulf, repeated his solicitations; and to give them still greater weight, produced a larger cup than the former, and added also a purse of gold. Upon these considerations, the unfortunate Pessacola once again plunged into the whirlpool, and was never heard of more."

CHAP. XVIII.

A SUMMARY ACCOUNT OF THE MECHANICAL PROPERTIES OF AIR.

Having described the earth and the sea, we now ascend into that fluid which surrounds them both; and which, in some measure supports and supplies all animated nature. As upon viewing the bottom of the ocean from its surface, we see an infinity of animals moving therein, and seeking food; so, were some superior being to regard the earth at a proper distance, he might consider us in the same light; he might from his superior station behold a number of busy little beings, immersed in the aerial fluid that every where surrounds them, and sedulously employed in procuring the means of subsistence. This fluid, though too fine for the gross perception of its inhabitants, might to his nicer organs of sight be very visible; and while he at once saw into its operations, he might smile at the varieties of human conjecture concerning it; he might readily discern, perhaps, the height above the surface of the earth to which this fluid atmosphere reaches; he might exactly determine the peculiar form of its parts which gives it the spring or elasticity with which it is endued: he might distinguish which of its parts were pure incorruptible air and which only made for a little time to assume the appearance, so as to be quickly returned back to the element from whence it came. But as for us, who are immersed at the bottom of this gulf, we must be contented with a more confined knowledge; and, wanting a proper point of prospect, remain satisfied with a combination of the effects.

One of the first things that our senses inform us of, is that although the air is too fine for our sight, it is very obvious to our touch. Although we cannot see the wind contained in a bladder, we can very readily feel its resistance; and though the hurricane may want colour, we often fatally experience that it does not want force. We have equal experience of the air's spring or elasticity; the bladder when pressed returns again, upon the pressure being taken away; a bottle, when filled, often bursts from the spring of air which is included.

So far the slightest experience reaches; but, by carrying experiment a little farther, we learn, that air also is heavy: a round glass vessel being emptied of its air, and accurately weighed, has been found lighter than when it was weighed with the air in it. Upon computing the superior weight of the full vessel, a cubic foot of air is found to weigh something more than an ounce.

From this experiment, therefore, we learn, that the earth, and all things upon its surface, are every where covered with a ponderous fluid, which rising very high over our heads must be proportionably heavy. For instance, as in the sea, a man at the depth of twenty feet sustains a greater weight of water, than a man at the depth of but ten feet; so will a man at the bottom of a valley have a greater weight of air over him, than a man on the top of a mountain.

From hence we may conclude, that we sustain a very great weight of air; and although, like men walking at the bottom of the sea, we cannot feel the weight which presses equally round us, yet the pressure is not the less real. As in morals we seldom know the blessings that surround us, till we are deprived of them; so here we do not perceive the weight of the ambient fluid till a part of it is taken away. If, by any means, we contrive to take away the pressure of the air from any one part of our bodies, we are soon made sensible of the weight upon the other parts. Thus, if we clap our hand upon the mouth of a vessel from whence the air has been taken away, there will thus be air on one side and none on the other; upon which we shall instantly find the hand violently sucked inwards; which is nothing more than the weight of the air upon the back of the hand that forces it into the space which is empty below.

As, by this experiment, we perceive that the air presses with great weight upon every thing on the surface of the earth, so by other experiments we learn the exact weight with which it presses. First, if the air be exhausted out of any vessel, a drinking vessel, for instance,[1] and this vessel be set with the mouth downwards in water, the water will rise up into the empty space, and fill the inverted glass; for the external air will, in this case, press up the water where there is no weight to resist; as, one part of a bed being pressed, makes the other parts, that have no weight upon them, rise. In this case, as was said, the water being pressed without, will rise in the glass; and would continue to rise (if the empty glass were tall enough) thirty-two feet high. In fact, there have been pipes made purposely for this experiment, of above thirty-two feet high, in which, upon being exhausted, the water has always risen to the height of thirty-two feet; there it has always rested, and never ascended higher. From this, therefore, we learn, that the weight of the air which presses up the water, is equal to a pillar or column of water which is thirty-two feet high; as it is just able to raise such a column and no more. In other words, the surface of the earth is every where covered with a weight of air, which is equivalent to a covering of thirty-two feet deep of water; or to a weight of twenty-nine inches and a half of quicksilver, which is known to be just as heavy as the former.

Thus we see that the air, at the surface of the earth, is just as heavy as thirty-two feet of water, or twenty-nine inches and a half of quicksilver; and it is easily found by computation, that to raise water thirty-two feet, will require a weight of fifteen pounds upon every square inch. Now, if we are fond of computations, we have only to calculate how many square inches are in the surface of an ordinary human body, and allowing every inch to sustain fifteen pounds, we may amaze ourselves at the weight of air we sustain. It has been computed, and found, that our ordinary load of air amounts to within a little of forty thousand pounds: this is wonderful! but wondering is not the way to grow wise.[2]

---

[1] This may be done by burning a bit of paper in the same, and then quickly turning it down upon the water.

[2] Whatever be the height to which the atmosphere extends, it is evident that the air in immediate contact with the surface of the earth must have to support the weight of the mass immediately above, whereby its particles must be forced nearer together; in the same way, that if a number of layers of wool were placed one above another, the undermost, from the pressure of those above, would have its fibres more closely approximated and massed together. The ancients—Aristotle, Socrates, and Plato—were aware that the air exerted a pressure on the earth; but it remained for Galileo, who suffered persecution under the unhallowed edicts of the inquisition, to show philosophers that the pressure of the air is sufficient to support a column of mercury thirty inches high. This he did by means of the barometer, which is described in the text. Toricellius, the pupil of Galileo, extended the experiment to other fluids, and discovered, that, in the same way, the pressure of the atmosphere will support a column of thirty-four feet of water, that fluid being three or four times lighter than mercury. Accordingly, the pressure of the atmosphere is the same as if the earth were covered with mercury to the depth of thirty inches, or with water to the depth of thirty-four feet. This being understood, we may add, that the air near the earth's surface having to support this superincumbent weight, has a density indicated by about an ounce Troy to a cubit foot; but the higher we ascend, the more this pressure and density must be diminished. On these facts rests the principle on which the barometer is constructed, which is nothing more than a tube containing mercury, which indicates, by its rise or fall, the greater or lesser weight of the air immediately above it. At the level of the sea, the column of air being longer, the mercury is forced high up the

Notwithstanding this be our ordinary load, and our usual supply, there are, at different times, very great variations. The air is not, like water, equally heavy at all seasons; but sometimes is lighter, and sometimes more heavy. It is sometimes more compressed, and sometimes more elastic or springy, which produces the same effects as an increase of its weight. The air, which at one time raises water thirty-two feet in the tube, and quick-

---

tube; but on the tops of high mountains, the column of air being shorter, the pressure is diminished, and the mercury then falls. When the barometer is carried from the level of the Thames to the top of St Paul's church, in London, the mercury falls about an inch, indicating an ascent of about five hundred feet; when to the top of Mont Blanc, it sinks half of its entire height, marking an elevation of fifteen thousand feet; and in Du Luc's balloon ascent, it fell to below twelve inches, indicating a height of twenty-one thousand feet above the surface of the earth. Hence the barometer is used as a convenient instrument for measuring the elevations of different places; but this is not all: every person must be familiar with it as a monitor of the weather. When the water which has been suspended in the air separates as rain, the weight of the air diminishes; and consequently, the mercury in the barometer sinks. On the contrary, the more serene and settled is the weather, the higher the barometer ranges. Approaching high winds, from disturbing the equilibrium of the atmosphere, are often indicated by a sudden sinking of the mercury in the barometer; hence is constructed the instrument known as the marine barometer, which differs from that used on shore only in having its tube contracted in one place, to prevent the rising and falling of the mercury with every motion of the ship, and which gives almost providential warning of approaching tempest. "The marine barometer," says Mr Arnott, "has not yet been in general use for many years, and the author was one of a numerous crew who probably owed their preservation to its almost miraculous warning. It was in a southern latitude—the sun had just set with placid appearance, closing a beautiful afternoon, and the usual mirth of the evening watch was proceeding, when the captain's order came to prepare with all haste for a storm. The barometer had begun to fall with appalling rapidity. As yet, the oldest sailors had not perceived a threatening in the sky, and were surprised at the extent and hurry of the preparations; but the required measures were not completed, when a more awful hurricane burst upon them than the most experienced had ever braved. Nothing could withstand it; the sails, already furled and closely bound to the yards, were riven away in tatters; even the bare yards and masts were in great part disabled; and, at one time, the whole rigging had nearly fallen by the board. Such, for a few moments, was the mingled roar of the hurricane above, of the waves around, and of the incessant peals of thunder, that no human voice could be heard; and, amidst the general consternation, even the trumpet sounded in vain. In that awful night, but for the little tube of mercury which had given the warning, neither the strength of the noble ship, nor the skill and energies of the commander, could have saved one man to tell the tale. On the following morning, the wind was again at rest; but the ship lay on the yet heaving waves, an unsightly wreck."

The pressure of the atmosphere being so considerable, how happens it that such a weight can be supported by living animals, for it is calculated that on a average its pressure amounts to fourteen pounds and a half on every square inch of the earth's surface, so that the human body must sustain a weight of from fifteen to twenty tons? This query, which has challenged the ingenuity of some of the most celebrated men who have distinguished themselves in the annals of science, has recently claimed the attention of the ingenious Dr Dalton of Manchester, whose discoveries have already done so much to advance the progress of chemistry. He has explained what by experience is proved to be the actual weight of the human body; he has then, by adding together the calculated weight of its solid and fluid parts, and the air which enters into it, allowing a surplus for that which permeates the bones and muscles, &c., found that the weight of the living body, as proved by experiment, is less than the calculated weight. Whence this discrepancy? "Upon the whole (says he) I am inclined to believe the true explanation of the difficulty will be found in this, that the *substance* of the body is pervious to air, and that a considerable portion of it constantly exists in the body during life, subject to increase and diminution according to the pressure of the atmosphere, in the same manner as it exists in water; and further, that when life is extinct, this air in some degree escapes, and renders the parts specifically heavier than when the vital functions were in a state of activity." The human body, then, is to be regarded as being throughout pervious to air, and as the elasticity and pressure within corresponds with that without, no weight is imposed on any part of it until the balance is destroyed; it is therefore a fallacy to speak of the human body having to support any such weight. When we place our hand over the glass of an air-pump, and withdraw the air below, the pressure of the atmosphere on the outside of the hand is scarcely felt, but the inside is swollen, rendered painful, and feels drawn into the receiver. When we ascend a mountain, and arrive at a region where the surrounding air is much rarified, the air within the substance of the body in like manner opposing an unequal pressure against that without, gives rise also to painful sensations, fulness and throbbing of the temples, and the most distressing lassitude. Dr Clarke, in describing his ascent to the summit of Mont Blanc, observes, "Every two or three minutes we all sunk down in the snow quite breathless, and scarcely able to utter a word. One of the guides had some bleeding from an accidental blow, not from simple rarefaction of the air. The blood appeared to me decidedly of a darker colour than natural; our lips were quite blue; our faces extremely contracted and pale, and the eyes very much sunk, with a deep dark zone beneath the lower eyelids; but no one had the least spontaneous hæmorrhage from the gums or eyes. Every start we cast a longing, lingering look at the summit, and then holding our heads low, pressed onwards till the feeling of exhaustion became irresistible, and we sunk again quite flat on the snow." These distressing sensations at such elevations, arise not only from the increased rarity of the air demanding a more rapid respiration, in order that the necessary quantity of air should traverse the lungs, which is always accompanied by an accelerated circulation; but, as above explained, from the air within the body being denser and more elastic, and exerting a greater pressure, than is met by any counterpoise without. As in the case of the hand over the partly exhausted air-pump, the vessels are distended. Thence arises a sense of extreme uneasiness; and the more delicate blood vessels in the eyes, mouth, and lungs, are occasionally ruptured. If the transition were more gradual, so as to allow time for the air within the body to acquire the same condition as the air without, such a loss of balance would not ensue. Indeed, there is reason to believe, that we might accustom ourselves to live under a much lighter pressure of atmosphere than we do, even under the weight of half an atmosphere. Mexico is 7775, and Quito 9550 feet above the level of the sea; yet, in neither of these silver twenty-nine inches, will not at another raise the one to thirty feet, or the other to twenty-six inches. This makes, therefore, a very great difference in the weight we sustain; and we are actually known, by computation, to carry at one time four thousand pounds of air more than at another.

The reason of this surprising difference in the weight of air, is either owing to its pressure from above, or to an increase of vapour floating in it. Its increased pressure is the consequence of its spring or elasticity, which cold and heat sensibly affect, and are continually changing.

This elasticity of the air is one of its most amazing properties; and to which it should seem nothing can set bounds. A body of air that may be contained in a nut shell, may easily, with heat, be dilated into a sphere of unknown dimensions. On the contrary, the air contained in a house, may be compressed into a cavity not larger than the eye of a needle. In short, no bounds can be set to its confinement or expansion; at least, experiment has hitherto found its attempts indefinite. In every situation, it retains its elasticity; and the more closely we compress it, the more strongly does it resist the pressure. If to the increasing the elasticity on one side by compression, we increase it on the other side by heat, the force of both soon becomes irresistible; and a certain French philosopher[1] supposed that air thus confined and expanding, was sufficient for the explosion of a world.

Many instruments have been formed to measure and determine these different properties of the air; and which serve several useful purposes. The barometer serves to measure its weight; to tell us when it is heavier, and when lighter. It is composed of a glass tube or pipe, of about thirty inches in length, closed up at one end: this tube is then filled with quicksilver; this done, the maker clapping his finger upon the open end, inverts the tube, and plunges the open end, finger and all, into a basin of quicksilver, and then takes his finger away; now the quicksilver in the tube will, by its own weight, endeavour to descend into that in the basin; but the external air, pressing on the surface of the quicksilver in the basin without, and no air being in the tube at top, the quicksilver will continue in the tube, being pressed up, as was said by the air, on the surface of the basin below. The height at which it is known to stand in the tube, is usually about twenty-nine or thirty inches when the air is heavy; but not above twenty-six when the air is very light. Thus, by this instrument, we can with some exactness determine the weight of the air; and, of consequence, tell before-hand the changes of the weather. Before fine dry weather, the air is charged with a variety of vapours, which float in it unseen, and render it extremely heavy, so that it presses up the quicksilver; or in other words, the barometer rises. In moist, rainy weather, the vapours are washed down or there is not heat sufficient for them to rise, so that the air is then sensibly lighter, and presses up the quicksilver with less force; or, in other words, the barometer is seen to fall. Our constitution seems also to correspond with the changes of the weather-glass; they are braced, strong and vigorous, with a large body of air upon them; they are languid, relaxed, and feeble when the air is light, and refuses to give our fibres their proper tone.

But although the barometer thus measures the weight of the air with exactness enough for the general purposes of life, yet it is often affected with a thousand irregularities that no exactness in the instrument can remedy, nor no theory account for. When high winds blow, the quicksilver generally is low: it rises higher in cold weather than in warm; and is usually higher at morning and evening than at mid-day: it generally descends lower after rain than it was before it. There are also frequent changes in the air, without any sensible alteration in the barometer.

As the barometer is thus used in predicting the changes of the weather, so is it also serviceable in measuring the heights of mountains, which mathematicians cannot so readily do: for, as the higher we ascend from the surface of the earth the air becomes lighter, so the quicksilver in the barometer will descend in proportion. It is found to sink at the rate of the tenth part of an inch for every ninety feet we ascend; so that in going up a mountain, if I find the quicksilver fallen an inch, I conclude, that I am got upon an ascent of near nine hundred feet high. In this there has been found some variation; into a detail of which, it is not the business of a natural historian to enter.

In order to determine the elasticity of air, the wind-gun has been invented, which is an instrument variously made; but in all upon the principle of compressing a large quantity of air into a tube, in which there is an ivory ball, and then giving the compressed elastic air free power to act, and drive the ball as di-

---

places do the inhabitants complain of the rarity of the atmosphere. In this country, winds, heat, the quantity of vapour suspended in the air, and other causes, many of them little known, cause sudden variations in its pressure; on which occasions, many of us experience a difficulty in moving, and feel indolent, and accuse the weather of being heavy,—whereas, in fact, it is lighter than it was before; and our uneasiness arises from the balance of the aerial pressure within not corresponding precisely to that which is without the body.

[1] Monsieur Amontons.

rected. The ball, thus driven, will pierce a thick board; and will be as fatal, at small distances, as if driven with gunpowder. I do not know whether ever the force of this instrument has been assisted by means of heat; certain I am, that this, which could be very easily contrived by means of phosphorus, or any other hot substance applied to the barrel, would give such a force as I doubt whether gunpowder itself could produce.

The air-pump is an instrument contrived to exhaust the air from round a vessel adapted to that purpose, called a receiver. This method of exhausting is contrived in the simple instrument, by a piston, like that of a syringe, going down into the vessel, and thus pushing out its air; which, by means of a valve, is prevented from returning into the vessel again. But this, like all other complicated instruments, will be better understood by a minute inspection, than an hour's description: it may suffice here to observe, that by depriving animals, and other substances, of all air, it shows us what the benefits and effects of air are in sustaining life, or promoting vegetation.

The digester is an instrument of still more extraordinary effects, than any of the former; and sufficiently discovers the amazing force of air, when its elasticity is augmented by fire. A common tea-kettle, if the spout were closed up, and the lid put firmly down, would serve to become a digester, if strong enough. But the instrument used for this purpose is a strong metal pot, with a lid to screw close on, so that, when down, no air can get in or return: into this pot meat and bones are put, with a small quantity of water, and then the lid screwed close: a lighted lamp is put underneath, and, what is very extraordinary, (yet equally true,) in six or eight minutes the whole mass, bones and all, are dissolved, into a jelly; so great is the force and elasticity of the air contained within, struggling to escape, and breaking in pieces all the substances with which it is mixed. Care, however, must be taken not to heat this instrument too violently: for then the inclosed air would become irresistible, and burst the whole, with, perhaps, a fatal explosion.

There are numberless other useful instruments made to depend on the weight, the elasticity, or the fluidity, of the air, which do not come within the plan of the present work; the design of which is not to give an account of the inventions that have been made for determining the nature and properties of air, but a mere narrative of its effects. The description of the pump, the forcing pump, the fire-engine, the steam-engine, the syphon, and many others, belong not to the naturalist, but the experimental philosopher: the one gives a history of Nature, as he finds she presents herself to him; and he draws the obvious picture: the other pursues her with close investigation, tortures her by experiment to give up her secrets, and measures her latent qualities with laborious precision. Much more, therefore, might be said of the mechanical effects of air, and of the conjectures that have been made respecting the form of its parts; how some have supposed them to resemble little hoops, coiled up in a spring; others, like fleeces of wool; others, that the parts are endued with a repulsive quality, by which, when squeezed together, they endeavour to fly off, and recede from each other. We might have given the disputes relative to the height to which this body of air extends above us, and concerning which there is no agreement. We might have inquired how much of the air we breathe is elementary, and not reducible to any other substance; and of what density it would become, if it were supposed to be continued down to the centre of the earth. At that place we might, with the help of figures, and a bold imagination, have shown it twenty thousand times heavier than its bulk of gold. We might also prove it millions of times purer than upon earth, when raised to the surface of the atmosphere. But these speculations do not belong to natural history; and they have hitherto produced no great advantages in that branch of science to which they more properly appertain.

CHAP. XIX.

AN ESSAY TOWARDS A NATURAL HISTORY OF THE AIR.

A LATE eminent philosopher has considered our atmosphere as one large chemical vessel, in which an infinite number of various operations are constantly performing. In it all the bodies of the earth are continually sending up a part of their substance by evaporation, to mix in this great alembic, and to float a while in common. Here minerals, from their lowest depths, ascend in noxious or in warm vapours, to make a part of the general mass; seas, rivers, and subterranean springs, furnish their copious supplies; plants receive and return their share; and animals, that by living upon, consume this general store, are found to give it back in great quantities when they die.[1] The air, therefore, that we breathe, and upon which we subsist, bears very little resemblance to that pure elementary body which was described in the last chapter; and which is rather a substance that may be conceived, than experienced to exist.[1] Air, such as we find it, is one of the most compounded bodies in all nature. Water may be reduced to a fluid every way resembling air, by heat; which, by cold, becomes water again. Every thing we see gives off its parts to the air, and has a little floating atmosphere of its own round it. The rose is encompassed with a sphere of its own odorous particles; while the night-shade infects the air with a scent of a more ungrateful nature. The perfume of musk flies off in such abundance, that the quantity remaining becomes sensibly lighter by the loss. A thousand substances that escape all our senses we know to be there; the powerful emanations of the load-stone, the effluvia of electricity, the rays of light, and the insinuations of fire. Such are the various substances through which we move, and which we are constantly taking in at every pore, and returning again with imperceptible discharge!

---

[1] Boyle, vol. ii. p. 593.

This great solution, or mixture of all earthly bodies, is continually operating upon itself; which, perhaps, may be the cause of its unceasing motion; but it operates still more visibly upon such grosser substances as are exposed to its influence; for scarcely any substance is found capable of resisting the corroding qualities of the air. The air, say the chemists, is a chaos furnished with all kinds of salts and menstruums; and, therefore, it is capable of dissolving all kinds of bodies. It is well known, that copper and iron are quickly covered, and eaten with rust; and that, in the climates near the equator, no art can keep them clean. In those dreary countries, the instruments, knives, and keys, that are kept in the pocket, are nevertheless quickly incrusted; and the great guns, with every precaution, after some years become useless. Stones, as being less hard, may be readily supposed to be more easily soluble. The marble of which the noble monuments of Italian antiquity are composed, although in one of the finest climates in the world, show the impressions which have been made upon them by the air. In many places they seem worm-eaten by time; and in others, they appear crumbling into dust. Gold alone seems to be exempted from this general state of dissolution; it is never found to contract rust though exposed ever so long: the reason of this seems to be, that sea-salt, which is the only menstruum capable of acting upon and dissolving gold, is but very little mixed with the air; for salt being a very fixed body, and not apt to volatilize, and rise with heat, there is but a small proportion of it in the atmosphere. In the elaboratories and shops, however, where salt is much used, and the air is impregnated with it, gold is found to rust as well as other metals.

---

[1] The atmospheric air, instead of being a simple element, as was supposed by the ancients, is a mixture of two gases,—the one named *oxygen*, the other *nitrogen;* besides which there is found a small portion of a more deleterious gas, known as *carbonic acid gas*, the fixed air which gives the sparkling buoyancy to soda water, champaigne, &c. The oxygen may be called the stimulating principal of the air. If a spark of light be plunged into it, the spark shines with a bright and dazzling lustre. If we were to inspire it, the pulse would become increased, the breathing more rapid, and the stimulus be too great for the endurance of life. Yet without its presence no animal could live, so that, when confined in a close apartment, as the quantity of this gas diminishes, our breathing becomes laborious, and, were not a fresh quantity admitted, respiration would entirely cease. Without its presence no flame is supported. A candle placed under a jar, when it has consumed the oxygen, becomes extinguished. It likewise acts upon metals entering into combination with them; as with mercury, lead, manganese, from which it may readily be expelled by the agency of heat. Such being the qualities of this gas, and as it could not be breathed pure, nature, in forming atmospheric air, has supplied a diluent in the nitrogen, seventy-nine parts of which added to twenty-one of oxygen constitute the air we breathe, and in this proportion the air is found at the highest altitudes and in all countries. Saussure analysed the air on the top of Mont Blanc, and found it consisted of the same constituents as the air in the valleys below. Berthollet analysed that of Egypt. and found it the same as the air in France. The carbonic acid gas, being so deleterious, exists only in a very small proportion,—one part in a thousand; but it varies, the quantity being greater in summer than in winter, and during the night than during the day. It was supposed at one time that it existed only accidentally in the air, but it is now ascertained that it exists in it over high mountain ranges. Gay Lussac brought it from twenty-three thousand feet above the level of the sea, that being the amazing height to which he ascended in his balloon. Every body is aware, that air is necessary for the support of human life. At each inspiration from twenty to forty inches of air are taken into the body, and this air consists of a certain quantity of oxygen, nitrogen, watery vapour and a very little carbonic acid; but at each expiration its condition is materially changed, the quantity of nitrogen remains the same, that of the watery vapour is little changed, but a part of the stimulating principle of the oxygen disappears, and an additional quantity of carbonic acid gas is emitted in its place; this applies to animals. It is evident therefore that a vast quantity of oxygen is continually in the act of being abstracted from the air, and to compensate for this loss, Nature has not failed to make an ample and all wise provision. This is done by the aid of plants and trees, which, during the day, in the process of their breathing, absorb the deleterious carbonic acid gas and give out a quantity of oxygen, so that while animals are deteriorating, plants are purifying the atmosphere. In the shade, however, and during night, it is found that plants emit carbonic acid: hence in a plain, only lightly shaded with wood, the air is salubrious, but in the interior of extensive forests it is thick and unwholesome. Accordingly, as the poet expresses it "all are but parts of one stupendous whole," and thus is the vegetable creation essential to the purification of the air we breathe. Air, we may also remark, is rendered very deleterious by gases and vapours generated in the earth. In the island of Java, the carbonic acid is thrown out in such quantities in a certain valley, that no animal can there exist, and birds flying low drop dead. It is a volcanic district, and appropriately called the "Valley of Death." At Fashlun in Sweden, noted for copper mines, the mineral exhalations so affect the air, that the silver in the purses of the possessors becomes discoloured. In Carniola, and Campania, the air is impregnated with sulphur. It has also been found to contain arsenic; and that such poisonous matters are sent from below, and arise from some subterranean action, may be inferred from the destruction of millions of fishes. Whole coasts have been found covered with dead fishes, supposed to have been killed by such poisonous matter from below; volcanoes have at such times been in a state of activity, and accompanied by earthquakes.

Bodies of a softer nature are obviously destroyed by the air.[1] Mr Boyle says, that silks brought to Jamaica, will, if there exposed to the air, rot, even while they preserve their colour; but if kept therefrom, they both retain their strength and gloss. The same happens in Brazil, where their clothes, which are black, soon turn of an iron colour; though in the shops, they preserve their proper hue.[2] In these tropical climates also, such are the putrescent qualities of the air, that white sugar will sometimes be full of maggots. Drugs and plasters lose their virtue, and become verminous. In some places they are obliged to expose their sweetmeats by day in the sun, otherwise the night-air would quickly cause them to putrefy. On the contrary, in the cold arctic regions, animal substances, during the winter, are never known to putrefy; and meat may be kept for months without any salt whatsoever. This experiment happily succeeded with the eight Englishmen that were accidentally left upon the inhospitable coasts of Greenland, at a place where seven Dutchmen had perished but a few years before; for killing some rein-deer for their subsistence, and having no salt to preserve the flesh, to their great surprise they soon found it did not want any, as it remained sweet during their eight months' continuance upon that shore.

These powers with which air is endued over unorganized substances, are exerted in a still stronger manner over plants, animals of an inferior nature, and lastly over man himself. Most of the beauty and the luxuriance of vegetation, is well known to be derived from the benign influence of the air; and every plant seems to have its favourite climate, not less than its proper soil. The lower ranks of animals also seem formed for their respective climates, in which only they can live. Man alone seems the child of every climate, and capable of existing in all. However, this peculiar privilege does not exempt him from the influences of the air; he is as much subject to its malignity as the meanest insect or vegetable.

With regard to plants, air is so absolutely necessary for their life and preservation, that they will not vegetate in an exhausted receiver. All plants have within them a quantity of air, which supports and agitates their juices. They are continually imbibing fresh nutriment from the air, to increase their store, and to supply the wants which they sustain from evaporation. When, therefore, the external air is drawn from them, they are no longer able to subsist. Even that quantity of air which they before were possessed of, escapes through their pores, into the exhausted receiver; and as this continues to be pumped away, they become languid, grow flaccid, and die. However, the plant or flower thus ceasing to vegetate, is kept, by being secured from the external air, a much longer time sweet than it would have continued had it been openly exposed.

That air which is so necessary to the life of vegetables, is still more so to that of animals; there are none found, how seemingly torpid soever, that do not require their needful supply. Fishes themselves will not live in water from whence the air is exhausted; and it is generally supposed that they die in frozen ponds, from the want of this necessary to animal existence. Many have been the animals that idle curiosity has tortured in the prison of a receiver, merely to observe the manner of their dying. We shall, from a thousand instances, produce that of the viper, as it is known to be one of the most vivacious reptiles in the world; and as we shall feel but little compassion for its tortures. Mr Boyle took a new caught viper, and shutting it up into a small receiver, began to pump away the air.[3] "At first, upon the air's being drawn away, it began to swell; sometime after he had done pumping, it began to gape, and open its jaws; being thus compelled to open its jaws, it once more resumed its former lankness: it then began to move up and down within, as if to seek for air, and after a while foamed a little, leaving the foam sticking to the inside of the glass; soon after, the body and neck grew prodigiously tumid, and a blister appeared upon its back; an hour and a half after, the receiver was exhausted, the distended viper moved, and gave manifest signs of life; the jaws remained quite distended; as it were from beneath the epiglottis, came the black tongue, and reached beyond it; but the animal seemed, by its posture, not to have any life; the mouth also was grown blackish within; and in this situation it continued for twenty-three hours. But upon the air being re-admitted, the viper's mouth was presently closed, and soon after opened again; and for some time those motions continued, which argued the remains of life." Such is the fate of the most insignificant or minute reptile that can be thus included. Mites, fleas, and even the little eels that are found swimming in vinegar, die for want of air. Not only these, but the eggs of these animals will not produce in vacuo, but require air to bring them to perfection.

---

[1] Buffon, vol. iii. p. 62.

[2] Ibid. p. 68.

[3] Boyle's Physico-Mechan. Exper. passim.

As in this manner air is necessary to their subsistence, so also it must be of a proper kind, and not impregnated with foreign mixtures. That fictitious air which is pumped from plants or fluids, is generally, in a short time, fatal to them. Mr Boyle has given us many experiments to this purpose. After having shown that all vegetable and most mineral substances, properly prepared, may afford air, by being placed in an exhausted receiver, and this in such quantities, that some have thought it a new substance, made by the alteration which the mineral or plant has undergone by the texture of its parts being loosened in the operation—having shown, I say, that this air may be drawn in great quantities from vegetable, animal, or mineral substances, such as apples, cherries, amber burned, or hartshorn[1]—he included a frog in artificial air, produced from paste; in seven minutes space it suffered convulsions, and at last lay still, and being taken out, recovered no motion at all, but was dead. A bird inclosed in artificial air, from raisins, died in a quarter of a minute, and never stirred more. A snail was put into the receiver, with air of paste; in four minutes it ceased to move, and was dead, although it had survived in vacuo for several hours: so that fictitious air proved a greater enemy to animals than even a vacuum itself.

Air also may be impregnated with fumes that are instantly fatal to animals. The fumes of hot-iron, copper, or any other heated metal, blown into the place where an animal is confined, instantly destroy it. We have already mentioned the vapours in the grotto Del Cane suffocating a dog. The ancients even supposed, that these animals, as they always ran with their noses to the ground, were the first that felt any infection. In short, it should seem that the predominance of any one vapour, from any body, how wholesome soever in itself, becomes infectious; and that we owe the salubrity of the air to the variety of its mixture.

But there is no animal whose frame is more sensibly affected by the changes of the air than man. It is true, he can endure a greater variety of climates than the lower order generally are able to do; but it is rather by the means which he has discovered of obviating their effects, than by the apparent strength of his constitution. Most other animals can bear cold or hunger better, endure greater fatigues in proportion, and are satisfied with shorter repose. The variations of the climate, therefore, would probably affect them the less, if they had the same means or skill in providing against the severities of the change. However this be, the body of man is an instrument much more nicely sensible of the variations of the air, than any of those which his own art has produced; for his frame alone seems to unite all their properties, being invigorated by the weight of the air, relaxed by its moisture, enfeebled by its heat, and stiffened by its frigidity.

But it is chiefly by the predominance of some peculiar vapour, that the air becomes unfit for human support. It is often found by dreadful experience, to enter into the constitution, to mix with its juices, and to putrefy the whole mass of blood. The nervous system is not less affected by its operations; palsies and vertigoes are caused by its damps; and a still more fatal train of distempers by its exhalations. In order that the air should be wholesome, it is necessary, as we have seen, that it should not be of one kind, but the compound of several substances; and the more various the composition, to all appearance, the more salubrious. A man, therefore, who continues in one place, is not so likely to enjoy this wholesome variety, as he who changes his situation; and, if I may so express it, instead of waiting for a renovation of air, walks forward to meet its arrival. This mere motion, independent even of the benefits of exercise, becomes wholesome, by thus applying a great variety of that healthful fluid by which we are sustained.

A thousand accidents are found to increase these bodies of vapour, that make one place more or less wholesome than another. Heat may raise them in too great quantities; and cold may stagnate them. Minerals may give off their effluvia in such proportion as to keep away all other kind of air; vegetables may render the air unwholesome by their supply; and animal putrefaction seems to furnish a quantity of vapour, at least as noxious as any of the former. All these united, generally make up the mass of respiration, and are, when mixed together, harmless; but any one of them, for a long time singly predominant, becomes at length fatal.

The effects of heat in producing a noxious quality in the air, are well known. Those torrid regions under the Line are always unwholesome. At Senegal, I am told, the natives consider forty as a very advanced time of life, and generally die of old age at fifty.

---

[1] Boyle's Physico-Mchan. vol. ii. p. 598.

At Carthagena,[1] in America, where the heat of the hottest day ever known in Europe is continual, where, during their winter season, these dreadful heats are united with a continual succession of thunder, rain, and tempests, arising from their intenseness, the wan and livid complexions of the inhabitants might make strangers suspect that they were just recovered from some dreadful distemper: the actions of the natives are conformable to their colour; in all their motions there is somewhat relaxed and languid: the heat of the climate even affects their speech, which is soft and slow, and their words generally broken. Travellers from Europe retain their strength and ruddy colour in that climate, possibly for three or four months; but afterwards suffer such decays in both, that they are no longer to be distinguished from the inhabitants by their complexion. However, this languid and spiritless existence is frequently drawled on sometimes even to eighty. Young persons are generally most affected by the heat of the climate, which spares the more aged; but all, upon their arrival on the coasts, are subject to the same train of fatal disorders. Few nations have experienced the mortality of these coasts so much as our own: in our unsuccessful attack upon Carthagena, more than three parts of our army were destroyed by the climate alone; and those that returned from that fatal expedition, found their former vigour irretrievably gone. In our more fortunate expedition, which gave us the Havannah, we had little reason to boast of our success; instead of a third, not a fifth part of the army were left survivors of their victory, the climate being an enemy that even heroes cannot conquer.

The distempers that thus proceed from the cruel malignity of those climates, are many: that, for instance, called the *Chapotonadas*, carries off a multitude of people; and extremely thins the crews of European ships, whom gain tempts into those inhospitable regions. The nature of this distemper is but little known, being caused in some persons by cold, in others by indigestion. But its effects are far from being obscure; it is generally fatal in three or four days: upon its seizing the patient, it brings on what is there called the *black vomit*, which is the sad symptom after which none are ever found to recover. Some, when the vomit attacks them, are seized with a delirium, that, were they not tied down, they would tear themselves to pieces, and thus expire in the midst of this furious paroxysm. This disorder, in milder climates, takes the name of the *bilious fever*, and is attended with milder symptoms, but very dangerous in all.

There are many other disorders incident to the human body, that seem the offspring of heat; but to mention no other, that very lassitude which prevails in all the tropical climates, may be considered as a disease. The inhabitants of India,[2] says a modern philosopher, sustain an unceasing languor, from the heats of their climate, and are torpid in the midst of profusion. For this reason, the great Disposer of nature has clothed their country with trees of an amazing height, whose shade might defend them from the beams of the sun; and whose continual freshness might, in some measure, temperate their fierceness. From these shades, therefore, the air receives refreshing moisture, and animals a cooling protection. The whole race of savage animals retire in the midst of the day, to the very centre of the forests, not so much to avoid their enemy man, as to find a defence against the raging heats of the season. This advantage which arises from shades in torrid climates, may probably afford a solution for that extraordinary circumstance related by Boyle, which he imputes to a different cause. In the island of Ternate, belonging to the Dutch, a place that had been long celebrated for its beauty and healthfulness, the clove trees grew in such plenty, that they in some measure lessened their own value: for this reason, the Dutch resolved to cut down the forests, and thus to raise the price of the commodity: but they had soon reason to repent of their avarice; for such a change ensued, by cutting down the trees, that the whole island from being healthy and delightful, having lost its charming shades, became extremely sickly, and has actually continued so to this day. Boerhaave considered heat so prejudicial to health, that he was never seen to go near a fire.

An opposite set of calamities are the consequence, in climates where the air is condensed by cold. In such places, all that train of distempers which are known to arise from obstructed perspiration, are very common;[3] eruptions, boils, scurvy, and a loathsome leprosy, that covers the whole body with a scurf, and white putrid ulcers. These disorders also are infectious; and, while they thus banish the patient from society, they generally accompany him to the grave. The men of those climates seldom attain to the age of fifty, but the women, who do not lead such laborious lives, are found to live longer.

The autumnal complaints which attend a wet summer, indicate the dangers of a moist air.[1] The long continuance of an east wind also, shows the prejudice of a dry one. Mineral exhalations, when copious, are every where known to be fatal; and although we probably owe the increase and luxuriance of vegetation to a moderate degree of their warmth, yet the natives of those countries where there are mines in plenty, but too often experience the noxious effects of their vicinity. Those trades that deal in the preparations of metals of all kinds, are always unwholesome; and the workmen, after some time, are generally seen to labour under palsies, and other nervous complaints. The vapours from some vegetable substances are well known to be attended with dangerous effects. The shade of the manchineel tree, in America, is said to be fatal, as was that of the juniper, if we may credit the ancients. Those who walk through fields of poppies, or in any manner prepare those flowers for making opium, are very sensibly affected with the drowsiness they occasion. A physician of Mr Boyle's acquaintance, causing a large quantity of black hellebore to be pounded in a mortar, most of the persons who were in the room, and especially the person who pounded it, were purged by it, and some of them strongly. He also gathered a certain plant in Ireland, which the person who beat it in a mortar, and the physician who was standing near, were so strongly affected by, that their hands and faces swelled to an enormous size, and continued tumid for a long time after.

---

[1] Ulloa, vol. i. p. 42.

[2] Linnæi Amœnitates, vol. v. p. 444.

[3] Crantz's History of Greenland, vol. i. p. 235.

But neither mineral nor vegetable steams are so dangerous to the constitution, as those proceeding from animal substances, putrefying either by disease or death. The effluvia that come from diseased bodies, propagate that frightful catalogue of disorders which are called *infectious*. The parts which compose vegetable vapours and mineral exhalations, seem gross and heavy, in comparison of these volatile vapours, that go to great distances, and have been described as spreading desolation over the whole earth. They fly every where; penetrate every where; and the vapours that fly from a single disease, soon render it epidemic.

The plague is the first upon the list of this class of human calamities. From whence this scourge of man's presumption may have its beginning, is not well known: but we well know that it is propagated by infection. Whatever be the general state of the atmosphere, we learn from experience, that the noxious vapours, though but singly introduced at first, taint the air by degrees; every person infected tends to add to the growing malignity; and as the disorder becomes more general, the putrescence of the air becomes more noxious, so that the symptoms are aggravated by continuance. When it is said that the origin of this disorder is unknown, it implies, that the air seems to be but little employed in first producing it. There are some countries, even in the midst of Africa, that we learn have never been infected with it; but continue for centuries unmolested. On the contrary, there are others, that are generally visited once a year, as in Egypt, which, nevertheless, seems peculiarly blessed with the serenity and temperature of its climate. In the former countries, which are of vast extent, and many of them very populous, every thing should seem to dispose the air to make the plague continual among them. The great heats of the climate, the unwholesomeness of the food, the sloth and dirt of the inhabitants, but, above all, the bloody battles which are continually fought among them, after which heaps of dead bodies are left unburied, and exposed to putrefaction. All these, one might think, would be apt to bring the plague among them; and yet, nevertheless, we are assured by Leo Africanus, that in Numidia the plague is not known once in a hundred years; and that in Negroland, it is not known at all. This dreadful disorder, therefore, must have its rise, not from any previous disposition of the air, but from some particular cause, beginning with one individual, and extending the malignity by communication, till at last the air becomes actually tainted by the generality of the infection.

---

[1] Instruments to ascertain the quantity of moisture present in the air, are termed *Hygrometers;* and are generally made of sponge, hair, or whalebone. That used by the celebrated Howard, who has furnished us with an admirable work on the climate of London, consists of a very slender strip of whalebone, which having been cut out of the piece across the grain, and reduced by scraping to the requisite thickness, with a length of about 3¼ inches, is so mounted on a brass frame, with a counteracting spring of wire, as to move an index round a circular scale of three inches circumference. The shortening of the strip of whalebone by dryness, and the lengthening by moisture, while the spring keeps it extended, respectively carry the index toward the extremes of the scale. Certain vegetables, more especially the wild oat and other kinds of grasses, and also some flowers, indicate the excess of moisture in the atmosphere, and are good hygrometers.

The electrical condition of the air merits notice, as it obviously influences a variety of atmospherical phenomena. The peculiar matter known under the form of electric fluid, seems to pervade all nature. It constantly seeks an equal distribution, and some bodies conduct it with more facility than others. Of this remarkable fluid the earth is the great reservoir, and when an equilibrium exists between it and atmospherical bodies, no sensible phenomena take place. Water is a better conductor than air, for which reason, during a thick fog, when the earth is surcharged with electrical matter, the electricity is conducted away without any sensible effects; but if the air remain dry, as it often does in this country during the summer and autumn months, then the fluid, instead of being conducted gently away, forces itself through the intervening space to the attracting body, and produces loud explosions. The electrical state of the air varies in different climates, and at different periods of the day; hence storms rarely occur immediately after sunrise, because the rising vapours then equalize the electric fluid without any sensible commotion; but they occur when the air has become dry during the more advanced period of the day and during the night. In summer, when the earth is dry, and the day warm, droughty, and serene, the atmospheric electricity increases from sunrise until mid-day, when it arrives at its maximum, and remains stationary a couple of hours, after which it diminishes until the fall of dew, and revives and increases again until midnight, to be shortly after almost extinguished.

When the electrical condition of the earth and clouds is dissimilar, and the equilibrium is disturbed, nervous people are often much affected, suffering difficulty of breathing, headach, painful anxiety, a sense of oppression, pains in the limbs, and mental depression, by which many of them are enabled to predict the approach of a storm.

The plague which spread itself over the whole world, in the year 1346, as we are told by Mezeray, was so contagious, that scarcely a village, or even a house, escaped being infected by it.[1] Before it had reached Europe, it had been for two years travelling from the great kingdom of Cathay, where it began by a vapour most horridly fœtid: this broke out of the earth like a subterranean fire, and upon the first instant of its eruption consumed and desolated above two hundred leagues of that country even to the trees and stones.

In that great plague which desolated the city of London, in the year 1665, a pious and learned schoolmaster of Mr Boyle's acquaintance, who ventured to stay in the city, and took upon him the humane office of visiting the sick and the dying, who had been deserted by better physicians, averred, that being once called to a poor woman who had buried her children of the plague, he found the room where she lay in so little, that it scarcely could hold any more than the bed whereon she was stretched. However, in this wretched abode, beside her, in an open coffin, her husband lay, who had some time before died of the same disease; and whom she, poor creature, soon followed. But what showed the peculiar malignity of the air, thus

---

[1] This dreadful pestilence, like the cholera, made its first appearance in the East. It arose in China, Tartary, India and Egypt, about the year 1345. It is ascribed by contemporary writers to a general corruption of the atmosphere, accompanied by the appearance of millions of small serpents and other venomous insects, and in other places, quantities of huge vermin, with numerous legs, and of a hideous aspect, which filled the air with putrid exhalations. Making every allowance for the ignorance and credulity of the age, it appears evident that some natural causes had contributed to corrupt the air, and load it with pestiferous vapours. Thus it came into England in the end of the year 1346; and it rained from the previous Christmas till midsummer, almost without ceasing. Great inundations followed, and accumulations of stagnant water, by which the whole atmosphere was poisoned. It appears that in many countries there were also earthquakes and tremblings of the earth. In many of the accounts given of these convulsions of nature, we may presume there was a good deal of exaggeration. But the testimonies are too numerous and respectable to leave any doubt that, before and during the pestilence, the elements were in a state of general convulsion which seems unparalleled in history.

The plague extended its ravages from India into the more western parts of Asia, into Egypt, Abyssinia, and thence into the northern parts of Africa. It proceeded over Asia Minor, Greece, and the islands in the Archipelago, almost depopulating the regions over which it stalked. It may be literally said to have *decimated* the world, even though we were to take this term as implying the destruction of *nine* in place of *one*, out of ten. The plague appears to have staid five or six months in one place, and then to have gone in search of fresh victims. Its symptoms are minutely described by many writers, and appear to have been the same in every country it visited. It generally appeared in the groin or under the armpits, where swellings were produced, which broke out into sores, attended with fever, spitting and vomiting of blood. The patient frequently died in half a day—generally within a day or two at the most. If he survived the third day, there was hope, though even then many fell into a deep sleep from which they never awoke.

From Greece the plague passed into Italy. The Venetians having lost 100,000 souls, fled from their city, and left it almost uninhabited. At Florence, 60,000 persons died in one year. France next became exposed to its ravages, and the mortality was horrible. The malady proceeded northward through France, till it reached Paris, where it cut off 50,000 people. About the same time it spread into Germany, where its ravages are estimated at the enormous amount of 12,400,000 souls.

At last this fearful scourge began to be felt in England. About the beginning of August, 1348, it appeared in the seaport towns on the coasts of Dorset, Devon, and Somersetshire, whence it proceeded to Bristol. The people of Gloucestershire immediately interdicted all intercourse with Bristol, but in vain. The disease ran, or rather fled, over Gloucestershire. Thence it spread to Oxford, and about the 1st of November reached London. Finally, it spread over all England, scattering everywhere such destruction, that, out of the whole population, hardly one person in ten was left alive. Incredible as this statement may appear, it seems borne out by the details of contemporary annalists. In the churchyard of Yarmouth, 7052 persons who died of the plague were buried in one year. In the city of Norwich, 57,374 persons died in six months. In the city of York, the mortality was equal. In London, the dead were thrown into pits—forty, fifty, or sixty, into one; and large fields were employed as burial places, the churchyards being insufficient for the purpose. No attempt was made to perform this last office with the usual care and decency. Deep and broad ditches were made, in which the dead bodies were laid in rows, covered with earth, and surmounted with another layer of bodies, which were also covered The mortality fell chiefly upon the poorer classes of society, and, among them, principally on old men, women and children. It appears that no precautions could prevent the influence of the contagion. The bonds of society were loosed; parents forsook children, and children parents; some fled to the country, others locked themselves up in their houses, and many went on board vessels. But everywhere the fugitives were followed, for the destroying angel had a foot on the waters as well as on the land. The pestilence spread into Wales and suffering from animal putrefaction, was, that the contagious steams had produced spots on the very wall of their wretched apartment: and Mr Boyle's own study, which was contiguous to a pest-house, was also spotted in the same frightful manner. Happily for mankind this disorder, for more than a century, has not been known in our island: and for this last age, has abated much of its violence, even in those countries where it is most common. Diseases, like empires, have their revolutions; and those which for a while were the scourge of mankind, sink unheard of, to give place to new ones, more dreadful, as being less understood.

For this revolution in disorders, which has employed the speculation of many, Mr Boyle accounts in the following manner: "Since," says he, "there want not causes in the bowels of the earth, to make considerable changes amongst the materials that nature has plentifully treasured up in those magazines, and as those noxious steams are abundantly supplied to the surface, it may not seem improbable, that in this great variety some may be found capable of affecting the human frame in a particular manner, and thus of producing new diseases. The duration of these may be greater or less, according to the lastingness of those subterraneous causes that produced them. On which account, it need be no wonder that some diseases have but a short duration, and vanish not long after they appear; whilst others may continue longer, as having under ground more settled and durable causes to maintain them."

From the recital of this train of mischiefs produced by the air upon minerals, plants, animals, and man himself, a gloomy mind may be apt to dread this indulgent nurse of nature as a cruel and inexorable stepmother: but it is far otherwise; and, although we are sometimes injured, yet almost all the comforts and blessings of life spring from its propitious influence. It would be needless to observe, that it is absolutely necessary for the support of our lives; for of this every moment's experience assures us. But how it contributes to this support, is not so readily comprehended. All allow it to be a friend, to whose benefits we are constantly obliged; and yet, to this hour, philosophers are divided as to the nature of the obligation. The dispute is, whether the air is only useful by its weight to force our juices into circulation:[1] or, whether, by containing a peculiar spirit, it mixes with the blood in our vessels, and acts like a spur to their industry.[2] Perhaps it may exert both these useful offices at the same time. Its weight may give the blood its progressive motion, through the larger vessels of the body; and its admixture with it, cause those contractions of all the vessels, which serve to force it still more strongly forward, through the minutest channels of the circulation. Be this as it may, it is well known, that that part of our blood which has just received the influx of the air in our bodies, is of a very different colour from that which has almost performed its circuit. It has been found, that the arterial blood, which has been immediately mixed with the air in the lungs, and, if I may so express it, is just beginning its journey through the body, is of a fine florid scarlet colour; while, on the contrary, the blood of the veins, that is returning from having performed its duty, is of a blackish crimson hue. Whence this difference of colour should proceed, is not well understood; we only know the fact, that this florid colour is communicated by the air; and we are well convinced, that this air has been admitted into the blood for very useful purposes.

Beside this vital principle in animals, the air also gives life and body to flame. A candle quickly goes out in an exhausted receiver; for having soon consumed the quantity of air, it then expires for want of a fresh supply. There has been a flame contrived that will burn under water; but none has yet been found that will continue to burn without air. Gunpowder, which is the most catching and powerful fire we know, will not go off in an exhausted receiver; nay, if a train of gunpowder be laid, so as that one part may be fired in the open air, yet the other part in vacuo will remain untouched, and unconsumed. Wood

---

into Ireland. In Scotland, the people are said to have brought the malady upon themselves. Taking advantage of the defenceless state of England, or rather resolved to avenge the injuries they had suffered under the Edwards, they made a hostile irruption with a large force into the country. But they had not proceeded far, when the plague overtook them. They perished in thousands, and carried the disease with them into Scotland, where its ravages were soon as destructive as they were in England. Early in the year 1349, the plague began to abate; and by the month of August it had entirely disappeared. Its consequences, however, continued for some time to be severely felt. During the prevalence of the disease, the cattle, for want of men to tend them, were allowed to wander about the fields at random, and perished in such numbers as to occasion a great scarcity. Though the fields, too, were covered with a plentiful crop of corn, much of it was lost for want of hands to reap and gather it in. The last dregs of this great plague were drained by that unfortunate race, the Jews. A belief spread over several countries that they had produced the pestilence by poisoning the wells and fountains; and in many places they were massacred in thousands by the infuriated populace. For centuries, indeed, the most dreadful crimes and all public calamities were attributed to this unfortunate people, and kings and nobles made these a pretext for extorting treasures from them.

[1] Keil. Robinson.

[2] Whytt upon vital and involuntary motions.

also set on fire, immediately goes out; and its flame ceases upon removing the air; for something is then wanting to press the body of the fire against that of the fuel, and to prevent the too speedy diffusion of the flame. We frequently see cooks and others, whose business it is to keep up strong fires, take proper precautions to exclude the beams of the sun from shining upon them, which effectually puts them out. This they are apt to ascribe to a wrong cause; namely, the operation of the light: but the real fact is, that the warmth of the sun-beams lessens and dissipates the body of the air that goes to feed the flame; and the fire, of consequence, languishes for want of a necessary supply.

The air, while it thus kindles fire into flame, is, notwithstanding, found to moderate the rays of light, to dissipate their violence, and to spread an uniform lustre over every object. Were the beams of the sun to dart directly upon us, without passing through this protecting medium, they would either burn us up at once, or blind us with their effulgence. But by going through the air, they are reflected, refracted, and turned from their direct course a thousand different ways; and thus are more evenly diffused over the face of nature.

Among the other necessary benefits the air is of to us, one of the principal is, its conveyance of sound. Even the vibrations of a bell, which have the loudest effect that we know of, cease to be heard when under the receiver of an air-pump. Thus all the pleasures we receive from conversation with each other, or from music, depend entirely upon the air.[1]

Odours likewise are diffused only by the means of air; without this fluid to swim in, they would for ever remain torpid in their respective substances; and the rose would affect us with as little sensations of pleasure, as the thorn on which it grew.

Those who are willing to augment the catalogue of the benefits we receive from this element, assert also, that tastes themselves would be insipid, were it not that the air presses their parts upon the nerves of the tongue and palate, so as to produce their grateful effects. Thus, continue they, upon the tops of high mountains, as on the Peak of Teneriffe, the most poignant bodies, as pepper, ginger, salt, and spice, have no sensible taste, for want of their particles being thus sent home to the sensory. But we owe the air sufficient obligations, not to be studious of admitting this among the number; in fact, all substances have their taste, as well on the tops of mountains, as in the bottom of the valley, and I have been one of many, who have ate a very savoury dinner on the Alps.

It is sufficient, therefore, that we regard the air as the parent of health and vegetation; as a kind dispenser of light and warmth; and as the conveyer of sounds and odours. This is an element of which avarice will not deprive us; and which power cannot monopolize. The treasures of the earth, the verdure of the fields, and even the refreshments of the stream, are too often seen going only to assist the luxuries of the great; while the less fortunate part of mankind stand humble spectators of their encroachments. But the air no limitations can bound, nor any landmarks restrain. In this benign element, all mankind can boast an equal possession; and for this we all have equal obligations to Heaven. We consume a part of it, for our own sustenance, while we live; and, when we die, our putrefying bodies give back the supply, which, during life, we had accumulated from the general mass.

CHAP. XX.

OF WINDS, REGULAR AND IRREGULAR.

Wind is a current of air. Experimental philosophers produce an artificial wind, by an instrument called an *æolipile*. This is nothing more than a hollow copper ball, with a long pipe; a tea-kettle might be readily made into one, if it were entirely closed at the lid, and the spout left open: through this spout it is to be filled with water, and then set upon the fire, by which means it produces a violent blast, like wind, which continues while there is any water remaining in the instrument. In this manner water is converted into a rushing air; which, if caught as it goes out, and left to cool, is again quickly converted into its former element. Besides this, as was mentioned in the former chapter, almost every substance contains some portions of air. Vegetables, or the bodies of animals left to putrefy, produce it in a very copious manner. But it is not only seen thus escaping from bodies, but it may be very easily made to enter into them. A quantity of air may be compressed into water, so as to be intimately blended with it. It finds a much easier admission into wine, or any fermented liquor: and an easier still into spirits of wine. Some salts suck up the air in such quantities, that they are made sensibly heavier thereby, and often are melted by its moisture. In this manner, most bodies being found either capable of receiving or affording it, we are not to be surprised at those streams of air that are continually fleeting round the globe.—Minerals, vegetables, and animals, contribute to increase the current; and are sending off their constant supplies. These, as they are differently affected by cold or heat, by mixture or putrefaction, all yield different quantities of air at different times; and the loudest tempests, and most rapid whirlwinds, are formed from their united contribution.

---

[1] It is well known that sound is transmitted by the undulation of the air; but the density of the air may be so diminished as no longer to permit the transmission of sounds of ordinary intensity. The report of a pistol on the top of Mont Blanc, sounds no louder than that of an Indian cracker. Almost every person must have observed the variations which occur in the transmission of sounds through the air, even in its ordinary state. The sound of distant church bells, when the air is perfectly calm, will often appear at a singular distance from, and often at a singular proximity to the listener. The sportsman on the open heath, will often notice the unaccountable variety of sounds produced by the discharge of his gun; all which must depend on the state of the surrounding air, on its density, the quantity of vapour suspended in it, and the clouds that extend above it. When the air is foggy, its undulations are interrupted, and the sound is dull and prolonged. When it is overarched with clouds, its undulations return back, producing a succession of echoes. And when, after night fall, the heat from the ground has been uniformly diffused, and the air is of an equal density, every sound is transmitted with peculiar intensity, whether we listen to the rippling of a distant stream, or the buzzing of some minute and unseen insect.

The sun is the principal instrument in rarefying the juices of plants, so as to give an escape to their imprisoned air; it is also equally operative in promoting the putrefaction of animals. Mineral exhalations are more frequently raised by subterranean heat. The moon, the other planets, the seasons, are all combined in producing these effects in a smaller degree. Mountains give a direction to the courses of the air. Fires carry a current of air along their body. Night and day alternately chill and warm the earth, and produce an alternate current of its vapours. These, and many other causes, may be assigned for the variety and the activity of the winds, their continual change, and uncertain duration.

With us on land, as the wind proceeds from so many causes, and meets such a variety of obstacles, there can be but little hopes of ever bringing its motions to conform to theory; or of foretelling how it may blow a minute to come. The great Bacon, indeed, was of opinion, that by a close and regular history of the winds, continued for a number of ages together, and the particulars of each observation reduced to general maxims, we might at last come to understand the variations of this capricious element; and that we could foretell the certainty of a wind with as much ease as we now foretell the return of an eclipse. Indeed, his own beginnings in this arduous undertaking seem to speak the possibility of its success; but, unhappily for mankind, this investigation is the work of ages, and we want a Bacon to direct the process.

To be able, therefore, with any plausibility, to account for the variations of the wind upon land, is not to be at present expected; and to understand any thing of their nature, we must have recourse to those places where they are more permanent and steady. This uniformity and steadiness we are chiefly to expect upon the ocean. There, where there is no variety of substances to furnish the air with various and inconstant supplies, where there are no mountains to direct the course of its current, but where all is extensively uniform and even; in such a place, the wind arising from a simple cause, must have but one simple motion. In fact, we find it so. There are many parts of the world where the winds, that with us are so uncertain, pay their stated visits. In some places they are found to blow one way by day, and another by night; in others, for one half of the year they go in a direction contrary to their former course; but, what is more extraordinary still, there are some places where the winds never change, but for ever blow the same way. This is particularly found to obtain between the tropics in the Atlantic and Æthiopic oceans; as well as in the great Pacific sea.

Few things can appear more extraordinary to a person who has never been out of our variable latitudes, than this steady wind, that for ever sits in the sail, sending the vessel forward; and as effectually preventing its return. He who has been taught to consider that nothing in the world is so variable as the winds, must certainly be surprised to find a place where there is nothing more uniform. With us their inconstancy has become a proverb; with the natives of those distant climates they may talk of a friend or a mistress as fixed and unchangeable as the winds, and mean a compliment by the comparison. When our ships are once arrived into the proper latitudes of the great Pacific ocean, the mariner forgets the helm, and his skill becomes almost useless; neither storms nor tempests are known to deform the glassy bosom of that immense sheet of waters; a gentle breeze, that for ever blows in the same direction, rests upon the canvas, and speeds the navigator. In the space of six weeks, ships are thus known to cross an immense ocean, that takes more than so many months to return. Upon returning, the trade wind, which has been propitious, is then avoided; the mariner is generally obliged to steer into the northern latitudes, and to take the advantage of every casual wind that offers, to assist him into port. This wind, which blows with such constancy one way, is known to prevail not only in the Pacific ocean, but also in the Atlantic, between the coasts of Guinea and Brazil; and, likewise, in the Æthiopic ocean. This seems to be the great universal wind, blowing from the east to the west, that prevails in all the extensive oceans, where the land does not frequently break the general current. Were the whole surface of the globe an ocean, there would probably be but this one wind, for ever blowing from the east, and pursuing the motions of the sun westward. All the other winds seem subordinate to this; and many of them are made from the deviations of its current. To form, therefore, any conception relative to the variations of the wind in general, it is proper to begin with that which never varies.

There have been many theories to explain this invariable motion of the winds; among the rest we cannot omit that of Dr Lyster, for its strangeness.[1] "The sea," says he, "in those latitudes, is generally covered over with green weeds, for a great extent; and the air produced from the vegetable perspiration of these, produces the trade wind." The theory of Cartesius was not quite so absurd. He alleged that the earth went round faster than its atmosphere at the equator; so that its motion, from west to east, gave the atmosphere an imaginary one from east to west; and thus an east wind was eternally seen to prevail. Rejecting those arbitrary opinions, conceived without force, and asserted without proof, Dr Halley has given one more plausible; which seems to be the reigning system of the day.

To conceive his opinion clearly, let us for a moment suppose the whole surface of the earth to be an ocean, and the air encompass-

---

[1] Captain Basil Hall, in a letter to J. F. Daniell, has entered largely into the history and theory of trade winds. We quote at length his excellent paper. The north-east trade wind (he says) is conceived to blow from the exact north-east point, nearly to the equator, when it takes a graceful bend, and blows more and more from the east point, till at length it becomes parallel to it; that is, blows from due east. The southeast trade, in like manner, is supposed to blow at first precisely at south-east, or at an angle of 45° with the meridian, and at last to assume an exact parallelism with the equinoctial line. This, however, is altogether erroneous. The real state of things is as follows. The trade winds in the Atlantic and Pacific ocean extend to about twenty-eight degrees of latitude on each side of the Equator, sometimes a degree or two farther; so that a ship, after passing the latitude of thirty degrees, may expect every day to enter them. It will perhaps assist the apprehension of the subject to suppose ourselves actually making a voyage to the Cape, first outwards, and then homewards; by which means we shall have to cross each of these winds twice. Shortly after leaving Madeira, which is in 32½°, we get into the Trades, and instead of finding the wind blowing from N. E., as the accounts would lead us to suppose, we shall find it blowing from east, or even sometimes a little southerly. You are seaman enough to be aware that, with the wind at east, a south course can readily be steered, first towards the Canaries, and then to the Cape de Verd islands. It is the most approved practice, I think, to pass just within sight of these islands to the westward of them; that is to say, leaving them on the left hand. As the ship advances to the southward, she finds the trade wind drawing round gradually from east to north-east, and finally to north-north-east; and even north at the southern verge of the north-east Trade. The last-named or northern direction, it will be observed, is at right angles to that usually assigned to it—due east, near the line. The southern limit to the north-east trade wind varies with the season of the year, reaching at one time to within three or four degrees of north latitude, and at other times, not approaching it nearer than ten or twelve degrees; but it never crosses the equator and enters the southern latitudes. It will aid the memory in this matter, to bear in mind that the line, which limits or marks the termination of this trade wind, follows the sun. In July and August it recedes from the equator, in pursuit, as it were, of the sun; while in December and January, when the sun has high southern declination, it reaches almost to the Line.

The great difficulty of the outward-bound voyage commences after the ship is deserted by the N. E. Trade, as she has then to fight across a considerable range of calms, and of what are called the "variables," where the wind has generally more or less southing in it. At certain seasons it blows freshly from the S. S W., and greatly perplexes the young navigator, who, from trusting to published accounts, expects to find the wind, not from south, but from east. This troublesome range varies in width from 150 to 550 miles; is widest in September, and narrowest in December or January I speak now of what takes place in the Atlantic; for it is not quite the same far at sea in the Pacific Ocean, where fewer modifying circumstances interfere with the regular course of the phenomena, than in the comparatively narrow neck formed by the protuberances of Africa and South America.

I may remark in passing, that it is upon a knowledge of these deviations from the general rule, which we are pleased to call *irregularities*, that much of the success of tropical navigation depends. A seaman who trusts to theory alone, will, in all probability, make a bad passage; while another, who relies solely upon past experience, will probably, if the season happens to be different, do quite as badly. The judicious navigator will endeavour to unite the two; and having attentively studied the theory of his subject, and sought to reduce every case to its principles, checking these from time to time by fresh experience, may be able, when occasions arrive where his own knowledge or that of others entirely fails him, to take that course which, all things considered, is most likely to serve the purpose he has in view.

But I am forgetting our voyager. We had reached that spot where the N. E. trade wind left us rolling in a dead calm, or with only an occasional violent squall, accompanied by deluges of rain, in a climate so hot that the slightest cat's paw of wind is hailed with the utmost delight. In process of time, the ship, by taking advantage of every such puff of wind, gets across this troublesome stage of her journey, and meets the S. E. Trade. It is very material to remark, that this wind does not blow from the east, as the navigator is led to expect, or in a direction parallel to the equator, and which would be to him a fair wind; but it meets him, as it is emphatically termed, *smack in the teeth*. Instead, therefore, of steering away S., or S. S. E. for the Cape of Good Hope, he is obliged to keep his wind as closely as possible, and he may think himself fortunate, in a dull sailer, if he can clear the coast of Brazil without making a tack. As he proceeds on, however, the wind gradually hauls to the south-eastward, then to E. S. E., and at last E., at the southern limit of the trade winds properly so called. Here, after a little baffling weather, he is almost certain of finding westerly winds, ing it on every side, without motion. Now it is evident, that that part of the air which lies directly under the beams of the sun, will be rarified; and if the sun remained for ever in the same place, there would be a great vacuity in the air, if I may so express it, beneath the place where the sun stood. The sun moving forward from east to west, this

---

which prevail in the latitudes beyond the Trades in both hemispheres.

Such are the phenomena most generally observed with respect to the regular trade winds outward bound. We shall now, in order to make things quite clear, invert the order of the voyage, and suppose the ship, after having reached the Cape of Good Hope, to turn back again. At first she may be plagued with westerly and north-westerly winds; but she will generally be able to stretch into the Trades, where she will at first find the wind hanging far to the east, and it may even have some northing in it at first. As she proceeds onwards to St Helena, which lies directly in the track of homeward-bound ships, the wind will draw to the east,—east-southeast,—southeast,—and, eventually, to south-southeast. At crossing the equator, it will probably be blowing from due south, and not (I must again beg you to take particular notice) from due east, as we are generally led to suppose. After reaching three or four degrees of north latitude, the ship will lose the south-east Trade, and re-enter the "variables," where, when it is not calm, she will generally find light southerly winds, and, at one period of the year, namely, about July and August, blowing briskly from the southwest, as far as ten or twelve degrees of north latitude. At other seasons, especially when the sun is near the line, a ship may expect light winds from all quarters of the compass, long calms, and now and then a furious squall, with deluges of rain. But at every season of the year, the homeward-bound passage, or that from the southward, is much easier made than the reverse.

On reaching the southern limit of the N. E. trade wind, the seaman finds the wind blowing in his face from the north, (exactly as he formerly met the S. E. Trade, blowing, not from east, but from the south Pole,) and is obliged to stretch away to the W. N. W. at first, and then N. W., as if he were going to the United States of America—not to Europe. As he sails on, and gets more into the Trade, it draws round gradually to N. E. and E. N. E., which allows of his "coming up" more and more every day, till at length he can steer north,—and even northeast; so that he is enabled frequently to "look up" for the Azores or Western Islands. By-and-by he bids adieu to the N. E. Trade, in about twenty-eight or twenty-nine degrees of north latitude, as he formerly did of the other Trade, in the correspondent degree south. In like manner, also, he will now almost always meet with westerly winds, which will carry him to the channel. It may be remarked by the way, that these westerly winds are not so regular as they are in the southern hemisphere, owing probably to the comparative absence of land, which enables the general principle, by which the winds are produced, to act there with greater uniformity.

If these descriptions have been rendered sufficiently intelligible to a person who has not before considered the subject, I think he will be in a situation to comprehend the theory: and when that is duly fixed in his imagination, he will find it useful to go back again to the facts stated above, with sharper powers of observation, and a judgment more fitted to arrange and generalise these materials to good purpose.

If air, at any particular spot, be heated, it becomes specifically lighter than the adjacent cooler parts, and consequently rises; while its place is speedily occupied by the contiguous less rarefied, or colder air. Now, the region of the globe lying between the tropics, or, we may say, between thirty degrees on each side of the equator, being exposed to the most direct rays of the sun, becomes heated; and the air in contact with this belt, or zone, becoming rarefied, rises with more or less rapidity, according to the circumstances under which the earth is situated. Where an open ocean is found, the incumbent air will be less heated, as in the Pacific, than where districts of dry earth are found, as in Mexico for instance. The partial vacuum thus formed will, in both hemispheres, be supplied by the adjacent air lying, we shall suppose, between the latitudes of thirty and fifty degrees. If this be admitted, most of the phenomena of the trade winds, will, I conceive, be readily explained. It must be granted, however, before proceeding farther, that a volume of air put into motion, is like every other body, possessed with a momentum, which will continue that motion till stopped by its friction against the fluid through which it is propelled, or by that of the surface of a solid body along which it may be impelled. Any one who has observed the ring of smoke sometimes projected from the mouth of a cannon will understand this; or the familiar experiment of blowing out a candle by means of the air forced from an uncharged gun, by means of one of the copper priming-caps, affords ample illustration that a mass of air once put in motion, will retain that motion like any other portion of matter.

The velocity of the earth's rotation at the equator is, in round numbers, 1000 miles an hour; at latitude 30° it is about 860, or about 140 miles an hour slower. The average velocity of the earth's easterly motion, in the space between the equator and latitude 30°, may be stated at 950 miles an hour; while that of the belt lying between thirty and forty degrees, is not much above 800 miles an hour.

The superincumbent air at these places respectively, *supposing no difference of temperature to exist*, would of course partake of the earth's velocity, and there would be an universal calm. But, if we suppose the tropical region to be heated, the air over it will instantly ascend, and take its station above the cold; while the colder and more dense air lying beyond the tropics will rush in to occupy its place, below that which has been heated. This hardly needs illustration; but, as I have more than once met with people who did not immediately see the consequences which follow from placing two fluids of different density side by side, I may suggest the experiment of a trough, divided, by a sluice in the centre, into two spaces, one of which may be filled with water, the other with quicksilver: both fluids will of course be at rest until the sluice be drawn up, when the heavier fluid will instantly rush in beneath the lighter, and the lighter will flow along above the quicksilver. If, instead of these fluids, we substitute hot and cold water, the same thing will take place, the cold always flowing under the hot, towards the place formerly occupied by the lower strata of the heated fluid; while the heated portion flows along over the cold, towards the place formerly occupied by the upper strata of the cold fluid. Exactly the same thing will take place if two portions of air, at different temperatures, be the contiguous fluids; though the phenomena will not now strike the senses so strongly.

It would not be difficult, I conceive, to have a globe fitted with a contrivance which should represent the operation of the trade winds; and perhaps a description of such an apparatus will be as ready a method as any other of explaining my views of this theory. Having taken a common globe, I would inclose its tropical region from thirty degrees north to thirty degrees south in a glass zone or coating concentric with the vacuity will follow too, and still be made under it. But while it goes on to make new vacuities, the air will rush-in to fill up those the sun has already made; in other words, as it is still travelling forward, the air will continually be rushing in behind, and pursue its motions from east to west. In this manner the air is put into motion by day; and by

---

globe, and also each of the belts lying between the latitudes of thirty and fifty degrees in like manner, with distinct cases placed respectively in close contact with the tropical glass coating, and divided from it by partitions removable at pleasure; I would fill the tropical case with hot water, and the middle latitude cases, or those embracing the space contained between the latitudes of thirty and fifty degrees in both hemispheres, with cold water; or, which would represent the actual fact still better, a broad ring of heated iron might be fixed round the equator to represent the torrid zone, while the middle or temperate latitudes, both north and south, should be encircled with rings of ice. The water might also be coloured in order to render the effect visible. Things being arranged as above described, and the globe being supposed *for the present* at rest, if the division between the hot and the cold fluids were removed, the cold water would gradually slide along *under* the hot towards the equator, while the heated water would be carried *over* the cold towards the poles; and, if nothing else were done, that is to say, if the globe were allowed to remain at rest, a mere circular interchange would take place. The temperate portions of the fluid, on coming into contact with the torrid zone of the globe, and being thereby heated and rendered specifically lighter, would necessarily rise; while the hot portion, on flowing towards the cooling substance in latitudes farther from the equator, would descend to occupy the place of the cold water drawn off to supply the place of the lighter heated water at the equator. A steady current would in this way be produced, running below towards the equator, and at right angles to it, and above towards the poles; this would evidently be the only motion impressed on the fluid as long as the globe stood still.

It is material to remark here, that this motion would be less and less obvious as the currents approached the equator, where the cold fluid would gradually become heated, and have a tendency to rise as well as to flow along, so that their course would be checked, till at length, at the equator, the opposite currents would meet and produce a calm.

While things are supposed to be in this situation, let the globe be put into rapid motion from west to east, we shall say, for the sake of illustration, at the rate of one thousand feet in a minute, while all the circumstances as to temperature remain as before. The cold water would continue to flow just as before, under the hot, towards the equator, where the rarefying cause existed, but it would now come to the equatorial regions, possessed, not only with a motion directly towards the equator, but with the easterly velocity due to that circle of latitude which it had left, or about eight hundred feet in a minute; and if we suppose these equatorial regions to be moving to the eastward at the average rate of nine hundred and fifty feet in the same interval, the cold water moving at the slower rate would inevitably at its first arrival there be left behind; or, which is the same thing, the surface of the globe would go faster to the eastward than the superincumbent water, and this, in effect, would produce an apparent or relative motion of the water from east to west; or, if the fluid in question were air, we should there have what we call an easterly wind.

This, in its most general sense, is what really takes place with the trade winds, and if what I have said be well understood, all the modifications which they undergo will be readily seen to follow.

The cold air, however, (it must be carefully observed,) which comes towards the equator, is acted upon by two forces, or, in other words, is influenced by two sources of motion; first, by that which has been impressed upon it, in a due easterly direction, by the rotation of the earth in the temperate latitudes it has left: and, secondly, by a motion, in the direction of the meridian, towards the equator, and at right angles to it. This last is caused by the air rushing in to fill up the space left by that which has been rarefied by the heat of the torrid zone, as shown in the first experiment where the globe stood still; in which case, it will be remembered, this was the only motion to which the fluid was exposed. The combined effect of these two motions is to produce the south-east trade wind in south latitude, and the north east trade on the other side of the equator.

When the comparatively slow-moving air of the temperate zone, caused by the rotatory motion of the earth to the east, first comes into contact with the quick moving or tropical belt of the globe, the difference of their velocities is great compared with the other motion of the air above described, or that directly towards the equator; and consequently the wind blows at the extreme edge of the trades nearly from the east point. As this cool air, however, is drawn nearer to the equator, and comes successively in contact with parallels of latitude moving faster and faster, this constant action of the earth's rapid easterly motion gradually imparts to the superincumbent air the rotatory velocity due to the equatorial regions which it has now reached; that is to say, there will be less and less difference at every moment between the easterly motion of the earth and the easterly motion of the air in question; while, at the same time, the other motion of the same air, or that which has a tendency to carry it straight towards the equator, having been exposed merely to the friction along the surface without meeting any such powerful counteracting influence as the earth's rotation, will remain nearly unchecked in its velocity. Thus, as I conceive, the trade wind must gradually lose the eastern character which it had on first quitting the temperate for the tropical region, in consequence of its acquiring more and more that of the rotatory motion of the earth due to the equatorial regions it has now reached. While this cause operates, therefore, to destroy the easterly direction of the trades, their meridional motion, as it may be called, or that towards the equator, by remaining constant or nearly so, will become more and more apparent, till at length, when the friction of the earth in its rotatory motion has reduced the velocity of the cool air to the tropical rate, there will be left only this motion towards the equator, which is found invariably to characterize the equatorial limits of both trade winds. This velocity, also, is at length checked, first, by its friction on the surface of the earth; secondly, by the air becoming heated, which causes it rather to rise than to flow along the surface; and thirdly, by the meeting of the two opposite currents—one from the north, the other from the south.

In confirmation of these doctrines, I may state that, in the trade winds, the higher clouds are very seldom, if ever, observed to go in the same direction as the wind below. In general, they are seen to move nearly in the contrary direction; and I find it noted in my journal, that on the top of the Peak of Teneriffe, the wind was blowing from the south-west, directly in the opposite direction to the trade wind below.

In what has been said above, the quickest moving or equatorial belt of the earth is assumed as being also the hottest and consequently that over which the air has the greatest tendency to rise. This, however, is not night the parts continue to impel each other till the next return of the sun, that gives a new force to the circulation.

In this manner is explained the constant east wind that is found blowing round the globe, near the equator. But it is also known, that as we recede from the equator on either side, we come into a trade wind, that continually blows from the poles, from the north on one side, or the south on the other, both directing towards the equator. This also proceeds from a similar cause with the former; for the air being more rarefied in those places over which the sun more directly darts its rays, the currents will come both from the north and the south, to fill up the intermediate vacuity.

These two motions, namely, the general one from east to west, and the more particular one from both the poles, will account for all the phenomena of trade winds; which, if the whole surface of the globe were sea, would undoubtedly be constant, and for ever continue to blow in one direction. But there are a thousand circumstances to break these air-currents into smaller ones; to drive them back against their general course; to raise or depress them; to condense them into storms, or to whirl them in eddies. In consequence of this, regard must be often had to the nature

---

the case universally; and where variations in this respect occur, effects very different from those described are the result. The most striking examples with which I am personally acquainted, of this deviation from the general law of the trade winds, or that which would obtain, were the earth a uniform mass of water, or land, occur in India and Mexico. That portion of the Pacific ocean, which stretches from the isthmus of Panama to the Peninsula of California, lies between eight and twenty-two degrees of north latitude. Now, the sun's rays strike directly upon the adjacent great territory of Mexico, and, by heating the land violently, cause the air to rise over it. But the vacuum is filled up not only from the north-ward, but by the comparatively cold air of the equatorial regions in the neighbourhood. This air coming from that part of the globe which revolves quickest, to one which moves more slowly, produces not an easterly, but westerly and south-westerly winds;—so that the navigator, who works by what is called the rule of thumb, and takes things for granted, instead of inquiring into them, will be very apt to make sad blunders in his navigation. I confess that I once laid myself open to an accusation little short of this, for which I had less excuse, perhaps, than another man, since, from having long speculated upon these topics, I had in a great measure satisfied myself of the truth of these theories. Yet when I was sent to visit the south-west coast of Mexico alluded to, and was left to my own choice as to the manner of performing the voyage, I miscalculated the probable effect of so vast a heater as Mexico, and expected to find the winds from east or north-east; and therefore began my voyage at Panama. I soon learned, however, to my cost, that, instead of being to windward of my port, I was dead to lee-ward of it, and I had to beat against westerly winds for many weeks.

After all, however, it is by this union of theory and experience (which is not the worse for being dearly bought), that effectual knowledge can be obtained; and the disasters into which we are led by ignorance must be serious indeed, if they be not more essentially profitable than mere unobservant success would have been. I mean that our finding things as we expected them is not always a proof that we have reasoned correctly,—for had I visited this coast at another season of the year, and found an east wind blowing, I might have called it the north-east trade, perhaps, and brought away none of the local knowledge, which is now, I trust, well engraved on my mind by the laborious process of rectifying my original error.

The monsoons in India, in like manner, are striking illustrations of this modified part of the theory. When the sun has great northern declination, the Peninsula of Hindostan, the north of India, and China, being heated, the quick moving equatorial air rushes to the north-ward to fill up the slow-moving rarefied space, and this supply, being possessed not only with a rapid eastern velocity, but with a motion from the south, produces the south-west monsoon in the Indian ocean, bay of Bengal, and in the China sea. When the sun, on the other hand, goes to the south, the same seas are occupied by air which, coming from regions beyond the northern tropic, possesses less easterly velocity than the space they are drawn to, which gives them an easterly character; and this combined with their proper motion, if I may so call it, from the north, produces the north-east monsoon.

There are numberless other less striking modifications of these principles, which give a high degree of interest to the science of navigation, particularly between the tropics;—but which it is needless to enter into just now It may however be useful to mention one important case which occurs in the Atlantic, when the sun has high northern declination, and the north of Africa is much heated: the equatorial air is then invited to the north, and a brisk south-west or south-south-west wind blows in the space between the equator and the southern limit of the north-east trade wind, which lies then in ten or twelve degrees of latitude, greatly to the astonishment of the inexperienced navigator, who, trusting to his books, expects a wind directly the reverse.

The same reasoning, precisely, will serve to account, not only for the direction, but for the degree of strength with which the winds blow between the trades and the polar regions,—that is, from 30° to 60°. The heated air which rises over the tropical belt, is carried towards the poles, till it is sufficiently cooled, when it descends, and, by encountering a part of the globe going to the eastward at a much slower rate, produces westerly winds. It must be observed also that, as the lower or cold air of this range proceeds towards the equator, it encounters, at every stage of its course along the surface, parallels of latitude moving faster and faster to the eastward, and consequently is exposed to more and more friction, by which means the relative difference between its velocity and that of the earth becomes at every moment less and less, till it subsides at length into a calm. But the equatorial air, on the contrary, in its progress towards the middle latitudes, comes constantly to regions of the globe moving with less and less velocity, so that it descends from the high regions of the atmosphere, along which it has passed with less friction to check its easterly motion, than the lower or cold current must have had to contend with, in its passage along the earth's surface. This equatorial air, therefore, comes with scarcely any diminution of its original velocity, into contact with a part of the earth moving more than a hundred miles more slowly to the eastward than itself. Consequently we have furious westerly gales as far as Madeira, on the one side, and the Cape of Good Hope on the other, which lie just beyond the north-east and south-east trade winds in the opposite hemispheres.

of the soil, the position of the high mountains, the course of the rivers, and even to the luxuriance of vegetation.

If a country, lying directly under the sun, be very flat and sandy, and if the land be low and extensive, the heat occasioned by the reflection of the sunbeams produces a very great rarefaction of the air. The deserts of Africa, which are conformable to this description, are scarcely ever fanned by a breath of wind by day; but the burning sun is continually seen blazing in intolerable splendour above them. For this reason, all along the coasts of Guinea, the wind is always perceived blowing in upon the land, in order to fill up the vacuity caused by the sun's operation. In those shores, therefore, the wind blows in a contrary direction to that of its general current; and is constantly found setting in from the west.

From the same cause it happens, that those constant calms, attended with deluges of rain, are found in the same part of the ocean. For this tract being placed in the middle, between the westerly winds blowing on the coast of Guinea, and the easterly trade winds that move at some distance from shore, in a contrary direction, the tendency of that part of the air that lies between these two opposite currents is indifferent to either, and so rests between both in torpid serenity; and the weight of the incumbent atmosphere, being diminished by the continual contrary winds blowing from hence, it is unable to keep the vapours suspended that are copiously borne thither; so that they fall in continual rains.

But it is not to be supposed, that any theory can account for all the phenomena of even those winds that are known to be most regular. Instead of a complete system of the trade winds, we must rather be content with an imperfect history. These,[1] as was said, being the result of a combination of effects, assume as great a variety as the causes producing them are various.

Besides the great general wind above mentioned, in those parts of the Atlantic that lie under the temperate zone, a north wind prevails constantly during the months of October, November, December, and January. These, therefore, are the most favourable months for embarking for the East Indies, in order to take the benefit of these winds, for crossing the Line: and it has been often found by experience, that those who had set sail five months before, were not in the least farther advanced in their voyage, than those who waited for the favourable wind. During the winter, off Nova Zembla, and the other arctic countries, a north wind reigns almost continually. In the Cape de Verd islands, a south wind prevails during the month of July. At the Cape of Good Hope, a north-west wind blows during the month of September. There are also regular winds, produced by various causes, upon land. The ancient Greeks were the first who observed a constant breeze, produced by the melting of the snows, in some high neighbouring countries. This was perceived in Greece, Thrace, Macedonia, and the Ægean sea. The same kind of winds are now remarked in the kingdom of Congo, and the most southern parts of Africa. The flux and reflux of the sea also produces some regular winds, that serve the purposes of trade; and, in general, it may be observed, that wherever there is a strong current of water, there is a current of air that seems to attend it.

Besides these winds that are found to blow in one direction, there are, as was said before, others that blow for certain months of the year one way, and the rest of the year the contrary way; these are called the *Monsoons*, from a famous pilot of that name, who first used them in navigation with success.[2] In all that part of the ocean that lies between Africa and India, the east winds begin at the month of January, and continue till about the commencement of June. In the month of August or September, the contrary direction takes place: and the west winds prevail for three or four months. The interval between these winds, that is to say, from the end of June to the beginning of August, there is no fixed wind; but the sea is usually tossed by violent tempests, proceeding from the north. These winds are always subject to their greatest variations, as they approach the land; so that on one side of the great peninsula of India, the coasts are, for near half the year, harassed by violent hurricanes and northern tempests: while, on the opposite side, and all along the coasts of Coromandel, these dreadful tempests are wholly unknown. At Java and Ceylon, a west wind begins to reign in the month of September; but at fifteen degrees of south latitude, this wind is found to be lost, and the great general trade wind from the east is perceived to prevail. On the contrary, at Cochin, in China, the west wind begins in March; so that these monsoons prevail, at different seasons, throughout the Indies. So that the mariner takes one part of the year to go from Java to the Moluccas; another from Cochin to Molucca; another from Molucca to China; and still another to direct him from China to Japan.

---

[1] Buffon, vol. ii. p. 230.

[2] Varenii Geographia Generalis, cap. 20. The term *Monsoon* is otherwise derived from *moussin*, a Malay word, signifying "season." It is in the Indian ocean alone that the *monsoons*, or half yearly winds, seem to destroy the uniformity of the general atmospheric movement.

There are winds also that may be considered as peculiar to certain coasts; for example, the south wind is almost constant upon the coasts of Chili and Peru; western winds almost constantly prevail on the coast of Terra Magellanica, and in the environs of the Straits le Maire. On the coasts of Malabar, north and north-west winds prevail continually; along the coast of Guinea, the north-west wind is also very frequent; and, at a distance from the coasts, the north-east is always found prevailing. From the beginning of November to the end of December, a west wind prevails on the coasts of Japan; and, during the whole winter, no ships can leave the port of Cochin, on account of the impetuosity of the winds that set upon the coast. These blow with such vehemence, that the ports are entirely choked up with sand, and even boats are not able to enter. However, the east winds that prevail for the other half of the year, clear the mouths of their harbours from the accumulations of the preceding winter, and set the confined ships at liberty. At the straits of Babelmandeb, there is a south wind that periodically returns, and which is always followed by a north-east.

Besides winds thus peculiar to certain coasts, there are others found to prevail on all the coasts, in warm climates, which, during one part of the day, blow from the shore, and during another part of it blow from the sea. The sea-breeze, in those countries, as Dampier observes, commonly rises in the morning about nine, proceeding slowly in a fine small black curl, upon the surface of the water, and making its way to refresh the shore. It is gentle at first, but increases gradually till twelve, then insensibly sinks away, and is totally hushed at five. Upon its ceasing, the land-breeze begins to take its turn, which increases gradually till twelve at night, and is succeeded in the morning by the sea-breeze again. Without all doubt, nothing could be more fortunate for the inhabitants of the warm countries where those breezes blow, than this alternate refreshment, which they feel at those seasons, when it is most wanted. The heat on some coasts would be insupportable, were it not for such a supply of air, when the sun has rarefied all that which lay more immediately under the coast. The sea-breeze temperates the heat of the sun by day; and the land-breeze corrects the malignity of the dews and vapours by night. Where these breezes, therefore, prevail, and they are very common, the inhabitants enjoy a share of health and happiness unknown to those that live much farther up the country, or such as live in similar latitudes without this advantage. The cause of these obviously seems to arise from the rarefaction of the air by the sun, as their duration continues with its appearance, and alters when it goes down. The sun, it is observed, equally diffusing his beams upon land and sea, the land being a more solid body than the water, receives a greater quantity of heat, and reflects it more strongly. Being thus, therefore, heated to a greater degree than the waters, it, of consequence, drives the air from land out to sea; but its influence being removed, the air returns to fill up the former vacuity. Such is the usual method of accounting for this phenomenon; but, unfortunately, these sea and land breezes are visitants that come at all hours. On the coasts of Malabar,[1] the land breezes begin at midnight, and continue till noon; then the sea-breezes take their turn, and continue till midnight. While again, at Congo, the land-breezes begin at five, and continue till nine the next day.

But if the cause of these be so inscrutable, that are, as we see, tolerably regular in their visitations, what shall we say to the winds of our own climate, that are continually shifting, and incapable of rest? Some general causes may be assigned, which nothing but particular experience can apply. And in the first place, it may be observed, that clouds and heat, and, in short, whatever either increases the density or the elasticity of the air, in any one place, will produce a wind there: for the increased activity of the air thus pressing more powerfully on the parts of it that are adjacent, will drive them forward, and thus go on, in a current, till the whole comes to an equality.

In this manner, as a denser air produces a wind, on one hand; so will any accident, that contributes to lighten the air, produce it on the other: for a lighter air may be considered as a vacuity, into which the neighbouring air will rush: and hence it happens, that when the barometer marks a peculiar lightness in the air, it is no wonder that it foretells a storm.

The winds upon large waters are generally more regular than those upon land. The wind at sea generally blows with an even steady gale; the wind at land puffs by intervals, increasing its strength, and remitting it, without any apparent cause. This, in a great measure, may be owing to the many mountains, towers, or trees, that it meets in its way, all contributing either to turn it from its course, or interrupt its passage.

The east wind blows more constantly than any other, and for an obvious reason: all other winds are, in some measure, deviations from it, and partly may owe their origin thereto. It is generally, likewise, the most powerful, and for the same reason.

---

[1] Buffon, vol. ii. p. 252.

There are often double currents of the air.[1] While the wind blows one way, we frequently see the clouds move another. This is generally the case before thunder: for it is well known that the thunder cloud always moves against the wind: the cause of this surprising appearance has hitherto remained a secret. From hence we may conclude, that weathercocks only inform us of that current of the air which is near the surface of the earth; but are often erroneous with regard to the upper regions, and, in fact, Derham has often found them erroneous.

Winds are generally more powerful on elevated situations than on the plain, because their progress is interrupted by fewer obstacles. In proportion as we ascend the heights of a mountain, the violence of the weather seems to increase, until we have got above the region of storms, where all is usually calm and serene. Sometimes, however, the storms rise even to the tops of the highest mountains; as we learn from those who have been on the Andes, and as we are convinced by the deep snows that crown even the highest.

Winds blowing from the sea are generally moister, and more attended with rains, than those which blow over extensive tracts of land; for the sea gives off more vapours to the air, and these are rolled forward upon land by the wind's blowing from thence.[2] For this reason our easterly winds that blow from the continent are dry in comparison of those that blow from the surface of the ocean, with which we are surrounded on every other quarter.

In general the winds are more boisterous in spring and autumn than at other seasons: for that being the time of high tides, the sea may communicate a part of its motions to the winds. The sun and moon, also, which then have a greater effect upon the waters, may also have some influence upon the winds: for there being a great body of air surrounding the globe, which, if condensed into water, would cover it to the depth of thirty-two feet, it is evident that the sun and moon will, to a proportionable degree, affect the atmosphere, and make a tide of air. This tide will be scarcely perceivable, indeed; but, without doubt, it actually exists; and may contribute to increase the vernal and autumnal storms, which are then known to prevail.

Upon narrowing the passage through which the air is driven, both the density and the swiftness of the wind is increased. For, as currents of water flow with greater force and rapidity by narrowing their channels; so also will a current of air driven through a contracted space, grow more violent and irresistible. Hence we find those dreadful storms that prevail in the defiles of mountains, where the wind, pushing from behind through a narrow channel, at once increases in speed and density, levelling or tearing up every obstacle that rises to obstruct its passage.

Winds reflected from the sides of mountains and towers, are often found to be more forceful than those in direct progression. This we frequently perceive near lofty buildings, such as churches or steeples, where winds are generally known to prevail, and that much more powerfully than at some distance. The air in this case, by striking against the side of the building, acquires additional density, and, therefore, blows with more force.

These different degrees of density, which the air is found to possess, sufficiently show that the force of the winds do not depend upon their velocity alone; so that those instruments called *anemometers*, which are made to measure the velocity of the wind, will by no means give us certain information of the force of the storm. In order to estimate this with exactness, we ought to know its density; which also these are not calculated to discover. For this reason we often see storms, with very powerful effects, that do not seem to show any great speed; and, on the contrary, we see these wind-measurers go round with great swiftness, when scarcely any damage has followed from the storm.

Such is the nature and the inconstancy of the irregular winds, with which we are best acquainted. But their effects are much more formidable in those climates near the tropics, where they are often found to break in upon the steady course of the trade winds, and to mark their passage with destruction. With us the tempest is but rarely known, and its ravages are registered as an uncommon calamity; but in the countries that lie between the tropics, and for a good space beyond them, its visits are frequent, and its effects are anticipated. In these regions the winds vary their terrors; sometimes involving all things in a suffocating heat; sometimes mixing all the elements of fire, air, earth, and water, together; sometimes, with a momentary swiftness, passing over the face of the country, and destroying all things in their passage; and sometimes raising whole sandy deserts in one country, to deposite them upon some other. We have little reason, therefore, to envy these climates the luxuriance of their soil, or the brightness of their skies. Our own muddy atmosphere, that wraps us round in obscurity, though it fails to gild our prospects with sunshine, or our groves with fruitage, nevertheless answers the call of industry. They may boast of a plentiful, but precarious, harvest; while with us, the labourer toils in a certain expectation of a moderate, but a happy, return.

---

[1] Dr Forster of Boreham has found, by a long series of experiments made with small air balloons, that the upper currents of air, which cross each other in various directions in more elevated regions of the atmosphere, *usually come down, and blow next to the surface of the earth and the waters, in the same order of succession in which they have previously blown aloft.* He thinks, likewise, that the currents of wind which he has encountered in his numerous journeys over mountains, in the pursuit of meteorological phenomena, have been explained on similar principles to those which blow over the sea; and that the Alpine gales which cross the mountain-tops in the Swiss and Savoyard Alps, descend and sweep the valleys within the space of thirty hours. These experiments were begun so long ago as the year 1811; and after fifty or more experiments with small balloons, and nearly double that number with large kites, tied one above another, so as to ascend to great heights, he has deduced the result, not only that upper currents descend to the earth, but also that gales of wind are usually circumvolvent, like whirlwinds of great extent, and do not, as has been hitherto supposed, blow in straight lines. Dr Forster has likewise made the important remark, that during his last aerial voyage in a very large balloon, filled with inflammable air, he moved in a circuitous or gyrating course, the periphery of which diminished, or, in other words, the curvature *increased* as the balloon *ascended*, and that in proportion as the spiral approached its vertex, at the elevation of above six thousand feet, the motion was slower. This circumstance is exceedingly curious, being the reverse of the mechanical law, according to which equal areas are described in equal times by revolving bodies, and it tends, therefore, to prove that the causes of wind are not mechanical, but electrical.

[2] Derham's Physico-Theol.

In Egypt, a kingdom so noted for its fertility, and the brightness of its atmosphere, during summer, the south winds are so hot, that they almost stop respiration; besides which, they are charged with such quantities of sand, that they sometimes darken the air as with a thick cloud.[1]

These sands are so fine, and driven with such violence, that they penetrate every where, even into chests, be they shut ever so closely. If these winds happen to continue for any length of time, they produce epidemic diseases, and are often followed by a great mortality. It is also found to rain but very seldom in that country: however, the want of showers is richly compensated by the copiousness of their dews, which greatly tend to promote vegetation.

In Persia, the winter begins in November, and continues till March. The cold at that time is intense enough to congeal the water; and snow falls in abundance upon their mountains. During the months of March and April, winds arise, that blow with great force, and seem to usher in the heats of summer. These return again, in autumn, with some violence; without, however, producing any dreadful effects. But during their summer, all along the coasts of the Persian Gulf, a very dangerous wind prevails, which the natives call the *Sameyel*, still more dreadful and burning than that of Egypt. and attended with instant and fatal effects. This terrible blast, which was, perhaps, the pestilence of the ancients, instantly kills all those that it involves in its passage. What its malignity consists in, none can tell, as none have ever survived its effects, to give information.[2] It frequently, as I am told, assumes a visible form, and darts, in a kind of bluish vapour, along the surface of the country. The natives, not only of Persia, but of Arabia, talk of its effects with terror; and their poets have not failed to heighten them with the assistance of imagination. They have described it as under the conduct of a minister of vengeance, who governs its terrors, and raises or depresses it, as he thinks proper.[3] These deadly winds are also known along the coasts of India, at Negapatam, Masulipatam, and Petapoli. But, luckily for mankind, the shortness of their duration diminishes the injuries that might ensue from their malignity.

The Cape of Good Hope, as well as many islands in the West-Indies, are famous for their hurricanes, and that extraordinary kind of cloud which is said to produce them. This cloud, which is the forerunner of an approaching hurricane, appears, when first seen, like a small black spot, on the verge of the horizon; and is called, by sailors, *the bull's eye*, from being seen so minute at a vast distance.[4] All this time a perfect calm reigns over the sea and land, while the cloud grows gradually broader as it approaches. At length, coming to the place where its fury is to fall, it invests the whole horizon with darkness. During all the time of its approach, a hollow murmur is heard in the cavities of the mountains; and beasts and animals, sensible of its approach, are seen running over the fields, to seek for shelter. Nothing can be more terrible than its violence when it begins. The houses in those countries, which are made of timber, the better to resist its fury, bend to the blast like osiers, and again recover their rectitude. The sun, which but a moment before blazed with meridian splendour, is totally shut out; and a midnight darkness prevails, except that the air is incessantly illuminated with gleams of lightning, by which one can easily see to read. The rain falls, at the same time, in torrents; and its descent has been resembled to what pours from the spouts of our houses after a violent shower. These hurricanes are not less offensive to the sense of smelling also, and never come without leaving the most noisome stench behind them. If the seamen also lay by their wet clothes, for twenty-four hours, they are all found swarming with little white maggots, that were brought with the hurricane. Our first mariners, when they visited these regions, were ignorant of its effects, and the signs of its approach; their ships, therefore, were dashed to the bottom at the first onset; and numberless were the wrecks which the hurricane occasioned. But, at present, being forewarned of its approach, they strip their masts of all their sails, and thus patiently abide its fury. These hurricanes are common in all the tropical climates. On the coasts of Guinea they have frequently three or four in a day, that thus shut out the heavens for a little space; and, when past, leave all again in former splendour. They chiefly prevail, on that coast, in the intervals of the trade winds; the approach of which clears the air of its meteors, and gives these mortal showers that little degree of wholesomeness which they possess. They chiefly obtain there during the months of April and May; they are known, at Loango, from January to April; on the opposite coast of Africa, the hurricane season begins in May; and, in general, whenever a trade wind begins to cease, these irregular tempests are found to exert their fury.

---

[1] The most destructive wind of Egypt is what is called the *Kamsin*, which generally prevails in March, April, and May.

[2] It is said of this wind, that if it happens to meet with a shower of rain in its course, and blows across it, it is at once deprived of its noxious quality.

[3] D'herbelot, Bibliotheque Oriental.

[4] The *water spout* or *syphon*, is a no less dangerous phenomenon. An account of it will be found in the succeeding chapter.

All this is terrible: but there is a tempest known in those climates, more formidable than any we have hitherto been describing, which is called, by the Spaniards, a *Tornado.* As the former was seen arriving from one part of the heavens, thus making a line of destruction; so the winds in this seem to blow from every quarter, and settle upon one destined place, with such fury, that nothing can resist their vehemence. When they have all met, in their central spot, then the whirlwind begins with circular rapidity. The sphere every moment widens, as it continues to turn, and catches every object that lies within its attraction. This also, like the former, is preceded by a flattering calm; the air is every where hushed, and the sea is as smooth as polished glass: however, as its effects are more dreadful than those of the ordinary hurricane, the mariner tries all the power of his skill to avoid it; which, if he fails of doing, there is the greatest danger of his going to the bottom. All along the coasts of Guinea, beginning about two degrees north of the line, and so downward, lengthwise, for about a thousand miles, and as many broad, the ocean is unnavigable, on account of these tornadoes. In this torrid region there reigns unceasing tornadoes, or continual calms; among which, whatever ship is so unhappy as to fall, is totally deprived of all power of escaping. In this dreadful repose of all the elements, the solitary vessel is obliged to continue, without a single breeze to assist the mariner's wishes except those whirlwinds, which only serve to increase his calamity. At present, therefore, this part of the ocean is totally avoided; and, although there may be much gold along the coasts of that part of Africa, to tempt avarice, yet there is something, much more dreadful than the fabled dragon of antiquity, to guard the treasure. As the internal parts of that country are totally unknown to travellers, from their burning sand and extensive deserts; so here we find a vast tract of ocean, lying off its shores, equally unvisited by the mariner.[1]

But of all these terrible tempests that deform the face of nature, and repress human presumption, the sandy tempests of Arabia and Africa are the most terrible, and strike the imagination most strongly. To conceive a proper idea of these, we are by no means to suppose them resembling those whirlwinds of dust that we sometimes see scattering in our air, and sprinkling their contents upon our roads or meadows. The sand-storm of Africa exhibits a very different appearance. As the sand of which the whirlwind is composed is excessively fine, and almost resembles the parts of water, its motion entirely resembles that of a fluid; and the whole plain seems to float onward, like a slow inundation. The body of sand thus rolling, is deep enough to bury houses and palaces in its bosom: travellers who are crossing those extensive deserts perceive its approach at a distance; and in general have time to avoid it, or turn out of its way, as it generally extends but to a moderate breadth. However, when it is extremely rapid, or very extensive, as sometimes is the case, no swiftness, no art, can avail; nothing then remains but to meet death with fortitude, and submit to be buried alive with resignation.

It is happy for us of Britain that we have no such calamity to fear:[2] for from this even some parts of Europe are not entirely free. We have an account given us in the history of the French Academy, of a miserable town in France, that is constantly in danger of being buried under a similar inundation; with which I will take leave to close this chapter, "In the neighbourhood of St Paul de Leon, in Lower Brittany,[1] there lies a tract of coun-

---

[1] The coasts of Guinea are remarkable for their fatal tornadoes and almost equally fatal calms, but the account given above by Goldsmith is somewhat overcharged.

[2] The storm which happened towards the end of the year 1703 is always referred to under the title of the "Great Storm," as the most remarkable on authentic record in this country. It appears, indeed, to have been a very violent one, and to have required no aid from the rude garnishing of the wonder-making publishers. It occurred on the night of the 26th and morning of the 27th of November, or according to our present mode of reckoning, the 8th of December, 1703. The force of the wind, which was very strong, caused immense damage. Houses were unroofed, and many blown down; ships were lost; and property to a great extent destroyed. The first Eddystone lighthouse per-

---

ished during the storm. Of lives which were lost may be mentioned, rear-admiral Beaumont, who perished with the crews of several ships, on the Goodwin Sands; and Dr Kiddar, the Bishop of Bath and Wells, who with his lady was killed by the falling of a portion of the episcopal palace. Amidst the numerous accidents, there occurred, as might naturally be supposed, many remarkable preservations. A day of fasting and humiliation was appointed by government, which was well observed by all ranks, from the impression which had been left on their minds by the effects of the tempest. A great many sermons were published which had been preached on this day, most of them containing such particulars of the storm as more immediately interested the preacher's locality.

Of accounts of the disaster, the most remarkable was that compiled by De Foe, the author of 'Robinson Crusoe.' It was not published with his name, but there appears to be no doubt that it was written by him. He has a chapter in it on "The Opinion of the Ancients that this Island was more subject to Storms than other parts of the World," which he labours to confute by tracing the notion partly to the state of the island before it was drained and enclosed by the industry of the inhabitants, and partly to the ignorance of the ancients in the art of navigation. Speaking of the storm, he says, "It is impossible to express the concern that appeared in every place. The distraction and fury of the night was visible in the faces of the people, and every body's first work was to visit and inquire after their friends and relatives. The next day or two was almost entirely spent in the curiosity of the people in viewing the havoc the storm had made, which was so universal in London, and especially in the outports, that nothing can be said sufficient to describe it."

The Rev. William Derham, a Fellow of the Royal Society, thus describes the storm in the 'Philosophical Transactions' for 1704. "Of the preceding parts of the year (1703), the months of April, May, June, and July, were wet in the southern parts of England, particularly in May, when more fell than in any month of any year since 1690; June also was very wet: and though July had considerable intermissions, yet on the 28th and 29th there fell violent showers of rain: and the newspapers gave accounts of great rains that month from divers places of Europe. On Thursday, November 25, the day before the tempest, in the morning, there was a little rain, the winds high in the afternoon. In the evening there was lightning, and, between nine and ten o'clock at night, a violent but short storm of wind, and much rain. Next morning, November 26, the wind was S. S. W., and high all day, and so continued till I was in bed and asleep. About twelve that night the storm awakened me, which gradually increased till near three that morning. And from thence till near seven it continued with the greatest violence; then it began to abate slowly, and the mercury to rise swiftly. The degrees of the wind's strength not being measurable, but by guess, I thus determined with respect to other storms: on February 7, 1699, was a terrible storm that did much damage; this I number ten degrees: another remarkable storm was February 3, 1702, at which time was the greatest descent of the mercury ever known; this I number nine degrees. But this last of November I number at least 15 degrees."

A bookseller in Paternoster Row, of the name of Taylor, having experienced a remarkable preservation during the storm, left a small sum of money for a sermon to be annually preached in commemoration of the event. Being a dissenter, the money was bequeathed to the chapel of which he was a member, in Little Wild Street, Lincoln's Inn Fields, where the observance is still kept up.

Passing by other remarkable storms since 1703, we come to the year 1783, commemorated by Cowper in his 'Task.' This was a remarkable and portentous kind of year. During a large portion of the summer a fog prevailed in various parts of Europe, which gave the sun a dull red appearance, such as the fogs of winter sometimes produce. In the earlier part of the year occurred the succession of earthquakes which laid waste Calabria. In August and October there were some remarkable meteoric phenomena, which were seen all over Great Britain, as well as on the Continent. Some parts of England were visited by an untimely frost, in the month of June, as described by Sir John Cullum in the 'Philosophical Transactions.' Cowper thus alludes to these things in the second book of the 'Task:'—

"Sure there is need of social intercourse,
Benevolence, and peace and mutual aid,
Between the nations, in a world that seems
To toll the death-bell of its own decease,
And, by the voice of all its elements,
To preach the general doom. When were the winds
Let slip with such a warrant to destroy?
When did the waves so haughtily o'erleap
Their ancient barriers, deluging the dry?
Fires from beneath, and meteors from above,
Portentous, unexampled, unexplained,
Have kindled beacons in the skies; and th' old
And crazy earth has had her shaking fits
More frequent, and foregone her usual rest."

Towards the end of July, beginning of August, and in the month of September, 1797, there was a succession of thunder and other storms, accompanied by violent rains, which were felt all over Great Britain, and caused considerable damage. Again, under September 12, 1798, the editor of the 'Gentleman's Magazine' says, "The storm of last night was as tremendous as any remembered by the oldest man living."

The beginning of 1808 was marked by one or two storms unusually severe. One occurred on the twelfth of February, which was preceded by a very heavy fall of snow. The winter of 1813-14 is memorable from the great frost. In December. 1814, a succession of gales occurred, in which the strength of the wind was at intervals very great. These gales visited almost every part of the coast of Great Britain and Ireland, and caused much damage.

The great floods in Scotland in 1829 can hardly have been forgotten by the reader. An account of these floods was published by Sir Thomas Dick Lauder, Bart. in a very interesting volume. "The heat," says Sir Thomas, "in the province of Moray, during the months of May, June, and July, 1829, was unusually great; and in the earlier part of that period the drought was so excessive as to kill many of the recently planted shrubs and trees. As the season advanced the fluctuation of the barometer became very remarkable. But the usual alterations of weather did not always follow these oscillations; it often happened that the results were precisely the reverse of its prognostications, and observers of the instrument began to lose all confidence in it. That these apparent derangements arose from certain electrical changes in the atmosphere there can be little doubt. The aurora borealis appeared with uncommon brilliancy about the beginning of July, and was frequently seen

[1] Histoire de l' Academie des Sciences, an. 1722.

try along the sea-side, which, before the year 1666, was inhabited, but now lies deserted, by reason of the sands which cover it, to the height of twenty feet; and which every year advance more and more inland, and gain ground continually. From the time mentioned above, the sand has buried more than six leagues of the country inward; and it is now but half a league from the town of St Paul: so that, in all appearance, the inhabitants must be obliged to abandon it entirely. In the country that has been overwhelmed, there are still to be seen the tops of some steeples peeping through the sand, and many chimneys that still remain above this sandy ocean. The inhabitants, however, had sufficient time to escape; but being deprived of their little all they had no other resource but begging for their subsistence. This calamity chiefly owes its advancement to a north or an east wind, raising the sand, which is extremely fine, in such great quantities, and with such velocity, that M. Deslands, who gave the account, says, that while he was walking near the place, during a moderate breeze of wind, he was obliged, from time to time, to shake the sand from his clothes and his hat, on which it was lodged in great quantities, and made them too heavy to be easily borne. Still further, when the wind was violent it drove the sand across a little arm of the sea, into the town of Roscoff, and covered the streets of that place two feet deep; so that they have been obliged to carry it off in carts. It may also be observed, that there are several particles of iron mixed with the sand, which are readily affected by the loadstone. The part of the coast that furnishes these sands is a tract of about four leagues in length, and is upon a level with the sea at high-water. The shore lies in such a manner as to leave its sands subject only to the north and east winds, that bear them farther up the shore. It is easy to conceive how the same sand that has at one time been borne a short way inland, may by some succeeding and stronger blast be carried up much higher; and thus the whole may continue advancing forward, deluging the plain, and totally destroying its fertility. At the same time too the sea, from whence this deluge of sand proceeds, may furnish it in inexhaustible quantities. This unhappy country, thus overwhelmed in so singular a manner, may well justify what the ancients and the moderns have reported concerning these tempests of sand in Africa, that they are said to destroy villages, and even armies in their bosom."[1]

CHAP. XXI.

OF METEORS AND SUCH APPEARANCES AS RESULT FROM A COMBINATION OF THE ELEMENTS.

In proportion as the substances of nature are more compounded and combined, their appearances become more inexplicable and amazing. The properties of water have been very nearly ascertained. Many of the qualities of air, earth, and fire, have been discovered and estimated; but when these come to be united by nature, they often produce a result which no artificial combinations can imitate; and we stand surprised, that although we are possessed of all those substances which nature make use of, she shows herself a much more various operator than the most skilful chemist ever appeared to be. Every cloud that moves, and every shower that falls, serves to mortify the philosopher's pride, and to show him hidden qualities in air and water, that he finds it difficult to explain. Dews, hail, snow, and thunder, are not less difficult for being more common. Indeed, when we reflect on the manner in which nature performs any one of these operations, our wonder increases. To see water, which is heavier than air, rising in air, and then falling in a form so very different from that in which it rose; to see the same fluid at one time descending in the form of hail, at another in that of snow; to see two clouds, by dashing against each other, producing an electrical fire, which no watery

---

afterwards, being generally accompanied by windy and unsteady weather, the continued drought having been already interrupted during the previous month by sudden falls of rain, partaking of the character of water-spouts."

The floods were caused by a deluge of rain which fell on the 3rd and 4th of August, by which the Spey, Findhorn, and other rivers and mountain brooks were raised to an unparalleled height, and a great extent of country converted for a time into an inland sea. Bridges, houses, and cattle were swept away, and about 3000 individuals, chiefly dependent on the soil for existence, were reduced to absolute want, which, however, was alleviated by the exertions of the benevolent. The property destroyed was very great.

The winter of 1833-34 was, perhaps, as stormy a one as any in our annals. From November till February it may be said to have blown one continued hurricane. Many hundred ships were wind-bound in our ports all that time, and there was great destruction and loss of life by shipwreck.

The storm which occurred on the 29th of November, 1836, was probably as violent as even the great storm of 1703, though, from its shorter duration, (and perhaps also from improvements in our social arrangements,) it did not commit similar damage.

[1] In Sicily a wind is known by the name of the *Sirocco*, so called because it is supposed to blow from Syria. It is fatal to vegetation, and destructive to mankind, especially to strangers; it depresses the spirits in an unusual degree and suspends the power of digestion.

composition that we know of can effect; these, I say, serve sufficiently to excite our wonder; and still the more in proportion as the objects are ever pressing on our curiosity. Much, however, has been written concerning the manner in which nature operates in these productions; as nothing is so ungrateful to mankind as hopeless ignorance.

And first, with regard to the manner in which water evaporates, and rises to form clouds, much has been advanced, and many theories devised. All water,[1] say some, has a quantity of air mixed with it; and the heat of the sun, darting down, disengages the particles of this air from the grosser fluid; the sun's rays being reflected back from the water, carry back with them those bubbles of air and water, which, being lighter than the condensed air, will ascend till they meet with a more rarefied air; and they will then stand suspended. Experience, however, proves nothing of all this. Particles of air or fire are not thus known to ascend with a thin coat of water; and, in fact, we know that the little particles of steam are solid drops of water. But, besides this, water is known to evaporate more powerfully in the severest frost, than when the air is moderately warm.[2] Dr Hamilton, therefore, of the university of Dublin, rejecting this theory, has endeavoured to establish another. According to him, as aqua fortis is a menstruum that dissolves iron, and keeps it mixed in the fluid; as aqua regia is a menstruum that dissolves gold; or as water dissolves salts to a certain quantity, so air is a menstruum that corrodes and dissolves a certain quantity of water, and keeps it suspended above. But however ingenious this may be, it can hardly be admitted: as we know by Mariotte's experiment,[3] that if water and air be inclosed together, instead of the air's acting as a menstruum upon the water, the water will act as a menstruum upon the air, and take it all up. We know also, that of two bodies, that which is most fluid and penetrating, is most likely to be the menstruum of the other; but water is more fluid and penetrating than air, and therefore the most likely of the two to be the menstruum. We know that all bodies are more speedily acted upon, the more their parts are brought into contact with the menstruum that dissolves them; but water inclosed with compressed air, is not the more diminished thereby.[4] In short, we know, that cold, which diminishes the force of other menstruums, is often found to promote evaporation. In this variety of opinion and uncertainty of conjecture, I cannot avoid thinking that a theory of evaporation may be formed upon very simple and obvious principles, and embarassed, as far as I can conceive, with very few objections.

We know that a repelling power prevails in nature, not less than an attractive one. This repulsion prevails strongly between the body of fire and that of water. If I plunge the end of a red-hot bar of iron into a vessel of water, the fluid rises, and large drops of it fly up in all manner of directions, every part bubbling and steaming until the iron be cold. Why may we not for a moment compare the rays of the sun, darted directly upon the surface of the water, to so many bars of red-hot iron, each bar indeed infinitely small, but not the less powerful? In this case, wherever a ray of fire darts, the water, from its repulsive quality, will be driven on all sides; and, of consequence, as in the case of the bar of iron, a part of it will rise. The parts thus rising however, will be extremely small; as the ray that darts is extremely so. The assemblage of the rays darting upon the water in this manner, will cause it to rise in a light thin steam above the surface; and as the parts of the steam are extremely minute, they will be lighter than air, and consequently float upon it. There is no need for supposing them bubbles of water filled with fire; for any substance, even gold itself, will float on air, if its parts be made small enough; or, in other words, if its surface be sufficiently increased. This water, thus disengaged from the general mass, will be still farther attenuated and broken by the reflected rays, and consequently, more adapted for ascending.

From this plain account, every appearance in evaporation may be easily deduced. The quantity of heat increases evaporation, because it raises a greater quantity of steam. The quantity of wind increases evaporation; for, by waving the surface of the water, it thus exposes a greater surface to the evaporating rays. A dry frost, in some measure, assists the quantity of evaporation; as the quantity of rays are found to be no way diminished thereby. Moist weather alone prevents evaporation; for the rays being absorbed, refracted, and broken, by the intervening moisture, before they arrive at the surface, cannot produce the effect; and the vapour will rise in a small proportion.

Thus far we have accounted for the ascent of vapours; but to account for their falling again, is attended with rather more difficulty. We have already observed, that the particles of vapour, disengaged from the surface of the water, will be broken and attenuated in their ascent, by the reflected, and even the direct rays, that happen to strike upon their minute surfaces. They will, therefore, continue to ascend, till they rise above the operation of the reflected rays, which reaches but to a certain height above the surface of the earth. Being arrived at this region, which is cold for want of reflected heat, they will be condensed, and suspended in the form of clouds. Some vapours that ascend to great heights, will be frozen into snow; others, that are condensed lower down, will put on the appearance of a mist, which we find the clouds to be, when we ascend among them, as they hang along the sides of a mountain. These clouds of snow and rain, being blown about by winds, are either entirely scattered and dispersed above, or they are still more condensed by motion, like a snow-ball, that grows more large and solid as it continues to roll. At last, therefore, they will become too weighty for the air which first raised them to sustain; and they will descend with their excesses of weight, either in snow or rain. But as they will fall precipitately, when they begin to descend, the air, in some measure, will resist the falling; for as the descending fluid gathers velocity in its precipitation, the air will increase its resistance to it, and the water will, therefore, be thus broken into rain; as we see, that water which falls from the tops of houses, though it begins in a spout, separates into drops before it has got to the bottom. Were it not for this happy interposition of the air, between us and the water falling from a considerable height above us, a drop of rain might fall with dangerous force, and a hailstone might strike us with fatal rapidity.

---

[1] Spectacle de la Nature, vol. ii.

[2] Memoires de l' Academie des Sciences, an. 1705.

[3] Mariotte, de la Nature de l'Air, pp. 97, 106.

[4] See Boyle's Works, vol. ii. p. 619.

In this manner, evaporation is produced by day; but when the sun goes down, a part of that vapour which his rays had excited, being no longer broken and attenuated by the reflecting rays, it will become heavier than the air, even before it has reached the clouds; and it will, therefore, fall back in dews, which differ only from rain in descending before they have had time to condense into a visible form.[1] Hail, the Cartesians say, is a frozen cloud, half melted, and frozen again in its descent. A hoar frost is but a frozen dew. Lightning we know to be an electrical flash, produced by

---

[1] This account of the formation of dew is erroneous, but it was not till long after Goldsmith's time that the true theory of dew was discovered. Dr Wells, in his Essay on Dew, published in 1814, first led the way to an accurate knowledge on this subject.

The conditions under which the phenomena of dew take place are the following:—the most plentiful deposit occurs when the weather is clear and serene; very little is ever deposited under opposite circumstances. It is never seen on nights both cloudy and windy. It is well known, likewise, that a reduction in the temperature of the air, and of the surface of the earth, always accompanies the falling of dew, the surface on which it is deposited being, however, colder than the air above.

These phenomena admit of an easy and elegant explanation from the well known effect of the radiation of caloric from bodies. This radiation constantly taking place in all bodies, it is obvious that the temperature of any body can remain the same only by its receiving from another source as many rays as it emits. In the case of the earth's surface, so long as the sun remains above the horizon, it continues to receive as well as to emit heat; but when the sun sinks below the horizon, no object is present in the atmosphere to exchange rays with the earth, which, still emitting heat into free space, must consequently experience a diminution in its temperature. It thus becomes not only many degrees cooler than in the daytime, but also cooler than the superincumbent air; and, as the atmosphere always contains watery vapour, this vapour becomes condensed on the cold surface: hence the origin of dew, and, if the temperature of the earth is below 32°, of hoar frost. And since the projection of heat into free space takes place most readily in a clear atmosphere, and is impeded by a cloudy atmosphere, it is under the former condition that dew and hoar frost are formed; for if the radiant caloric, proceeding from the earth, is intercepted by the clouds, an interchange is established, and the ground retains nearly, if not quite, the same temperature as the adjacent portions of air.

Whatever circumstances favour radiation, favour also the production of dew; and, accordingly, under the same exposure, dew is much more copiously deposited on some surfaces than on others. Gravel walks and pavements project heat and acquire dew less readily than a grassy surface. Rough and porous surfaces, as shavings of wood, take more dew than smooth and solid wood. Glass projects heat rapidly, and is as rapidly coated with dew. But bright metals attract dew much less powerfully than other bodies. Water, which stands at the heat of radiating substances, is seen to condense the vapour of the superincumbent air in such a manner as to create thick mists and fogs over its surface. The unusual abundance of precipitated moisture over ponds and streams is attributable, however, not merely to the inferior temperature of their waters to the air, arising from radiation, but to the circumstance that more moisture is ordinarily contained in such air, since the sheltered situation it enjoys prevents its being borne away by those aerial currents prevailing elsewhere.

An acquaintance with the cause which produces dew and hoar frost enables us to understand the *rationale* of the process resorted to by gardeners to protect tender plants from cold, which consists simply in spreading over them a thin mat or some flimsy substance. In this way, the radiation of their heat to the heavens is prevented, or, rather, the heat which they emit is returned to them from the awning above, and they are preserved at a temperature considerably higher than that of the surrounding atmosphere. To ensure the full advantage of this kind of protection from the chill of the air, the coverings should not touch the bodies they are intended to defend. Garden walls, operate, in part, upon the same principle. In warm climates the deposition of dewy moisture on animal substances hastens their putrefaction. As this usually happens only in clear nights, it was anciently supposed that bright moonshine favoured animal corruption.

This rapid emission of heat from the surface of the ground enables us to explain the artificial formation of ice, during the night, in Bengal, while the temperature of the air is above 32°. The nights most favourable for this effect are those which are the calmest and most serene, and in which the air is so dry as to deposit little dew after midnight. Clouds and frequent changes of wind never fail to interrupt the congelation. Three hundred persons are employed in this operation at one place. The enclosures formed on the ground are four or five feet wide, and have walls only four inches high. In these enclosures, previously bedded with dry straw, the opposition of two clouds; and thunder to be the sound proceeding from the same, continued by an echo reverberated among them. It would be to very little purpose to attempt explaining exactly how these wonders are effected; we have so little insight into the manner in which these meteors are found to operate upon each other; and therefore we must be contented with a detail rather of their effects than their cause.

In our own gentle climate, where nature wears the mildest and kindest aspect, every meteor seems to befriend us. With us, rains fall in refreshing showers to enliven our fields, and to paint the landscape with a more vivid beauty. Snows cover the earth, to preserve its tender vegetables from the inclemency of the departing winter. The dews descend with such an imperceptible fall as no way injures the constitution. Even thunder is seldom injurious; and it is often wished for by the husbandman to clear the air, and to kill the numberless insects that are noxious to vegetation. Hail is the most injurious meteor that is known in our climate; but it seldom visits us with violence, and then its fury is but transient.[1]

---

broad, shallow, unglazed pans are set, containing water. Wind, which so greatly promotes evaporation, prevents the freezing altogether; and dew forms, in a greater or less degree, during the whole of the nights most productive of ice. The straw is carefully preserved dry, since if, by accident, it becomes moistened by the spilling of water, it conducts heat, and raises vapour from the ground, so as greatly to impede the congelation.

The radiation from the earth's surface is one of those happy provisions for the necessities of living beings, with which nature everywhere abounds. The heavy dews which fall in tropical regions are, in the highest degree, beneficial to vegetation, which, but for this supply of moisture, would, in countries where scarcely any rain falls for months, be soon scorched and withered. But, after the high temperature of the day, the ground radiates under these clear skies with great rapidity; the surface is quickly cooled, even to a great extent, and, as soon as this refreshing cold is produced, the watery vapour, which, from the great daily evaporation, exists in large quantities in the atmosphere, is deposited abundantly. This deposition is more plentiful, also, on plants, from their greater radiating power; while, on hard, bare ground and stones, where it is less wanted, it is comparatively trifling. In cold climates, the earth, being cold and sufficiently moist, requires little dew; accordingly the clouds, which are so common in damp and chilly regions, prevent the radiation of heat: the surface is thus preserved warm, and the deposition of dew is, in a great measure, prevented.

The water of dew, when collected, has been superstitiously considered to possess various remarkable, and almost supernatural qualities. Borelli asserts that, in some instances, dew-water is capable of dissolving gold. In the West Indies, and in other tropical climates, numerous diseases are attributed to its noxious qualities. But such notions are, for the most part, as fanciful as the popular virtues of May-dew, which, in this country, has been considered an excellent cosmetic, capable of clearing and beautifying the complexion. It may, however, be observed, that some plants give out so much carbonic acid as to impregnate very agreeably the dew-water formed on them; and this, in the peninsula of India, is collected as a luxury, and used medicinally. It is obtained by spreading pieces of muslin cloth in the flowering sennaga, from which, when well saturated, the moisture is wrung out, and preserved for use. It is an old observation, that the presence of dew assists the putrefaction of animal substances. This may be accounted for thus: the presence of moisture promotes, and is indeed essential to, the decomposition of animal matter, and, on bright moonlight nights, the air being generally still, and the firmament unclouded, such substances radiate their heat very freely, and soon become covered with dew. It is neither the dew-water, therefore, nor the moonbeams, which are charged with any specific morbid influence. Thus, in the blindness of humanity, do we often mistake the very facts before us, and take erroneous data for the foundation of our most favourite theories; but the history of the world proves that truth is eternal and progressive, and, in the end, must triumph over error and superstition.

There is a species of dew which is sweet and grateful to the taste, named *honey dew*, which often collects on the leaves of plants in very considerable quantities. It is now known to naturalists that it is occasioned by insects (of the genus *Aphis*) which inhabit the under side of the leaves, and shed this liquor on the surface of those below. This little creature seems to subsist by drawing the juices from the sap-vessels, and, by some peculiarity of constitution, rejects the sweet or saccharine matter which falls on the leaves below, and afterwards affords nutriment to many other insects. Ants are so fond of it, that a whole colony may be found travelling to the highest branches of a tree in search of it.

[1] Hail is formed by the congelation of vapour in the higher regions of the atmosphere; and this arises from the warmer air in which the vapour was suspended mixing suddenly with an intensely cold current of air. Hail is generally defined to be frozen rain; but it differs from ice in this, that the hailstones are not formed of single pieces of ice, but of small particles agglutinated together, some of which are very hard, like perfect ice, while others are soft as snow, or resemble snow that has been hardened by frost. When hailstones are broken open, or cut across, they are sometimes within found to be of a spongy structure; sometimes the interior presents a very beautiful radiated appearance, and not unfrequently exhibits regular and very remarkable concentric plates. Generally, the centre of the hailstone is harder than its surface, and occasionally presents us with a nucleus, or sort of core, imbedded in which, bits of straw, wood, and earth, have been found; substances which, it may be presumed, were elevated from the surface of the earth by the action of a whirlwind, or some similar meteor. Hailstones vary much in shape: they are generally oval or round, but sometimes thin, flat, irregularly globular, angular, pyramidal, occasionally irregular, having a central point whence proceed numerous icy spiculæ, like rays in all directions; and also, although more rarely, they have appeared as six-sided prisms. A few years ago, a tremendous storm occurred in Gloucestershire, the most remarkable circumstance attending which, was the hail-shower by which it was accompanied. "It may be doubted," says the Athenæum, "whether such a name as hail be applicable, for the masses of ice which fell in places where the storm most fiercely raged, bore no resemblance to hailstones in magnitude or formation, most of them being of a very irregular shape, broad, flat, and ragged, and many measuring nine inches in circumference; they appeared like fragments of a vast plate of ice broken into small masses by its descent towards the earth." On the 4th of June, in the year 1814, hail fell at Cincinnati in North America, the pieces of which are described, in the ac-

One of the most dreadful storms we hear of,[1] was that of Hertfordshire, in the year 1697. It began by thunder and lightning, which continued for some hours, when suddenly a black cloud came forward, against the wind, and marked its passage with devastation. The hailstones which it poured down, being measured, were found to be many of them fourteen inches round, and consequently as large as a bowling-green ball. Wherever it came, every plantation fell before it; it tore up the ground, split great oaks, and other trees, without number; the fields of rye were cut down, as if levelled with a scythe; wheat, oats, and barley, suffered the same damage. The inhabitants found but a precarious shelter, even in their houses, their tiles and windows being broke by the violence of the hailstones, which, by the force with which they came, seemed to have descended from a great height. The birds, in this universal wreck, vainly tried to escape by flight; pigeons, crows, rooks, and many more of the smaller and feebler kinds, were brought down. An unhappy young man, who had not time to take shelter, was killed; one of his eyes was struck out of his head, and his body was all over black with bruises; another had just time to escape, but not without the most imminent danger, his body being bruised all over. But what is most extraordinary, all this fell within the compass of a mile.

Mezeray, in his history of France, tells us of a shower of hail much more terrible, which happened in the year 1510, when the French monarch invaded Italy. There was, for a time, a horrid darkness, thicker than that of midnight, which continued till the terrors of mankind were changed to still more terrible objects, by thunder and lightning breaking the gloom, and bringing on such a shower of hail, as no history of human calamities could equal. These hailstones were of a bluish colour; and some of them weighed not less than a hundred pounds. A noisome vapour of sulphur attended the storm. All the birds and beasts of the country were entirely destroyed. Numbers of the human race suffered the same fate. But what is still more extraordinary, the fishes found no protection from their native element; but were equal sufferers in the general calamity.

These, however, are terrors that are seldom exerted in our mild climates. They only serve to mark the page of history with wonder; and stand as admonitions to mankind, of the various stores of punishment, in the hands of the Deity, which his power can treasure up, and his mercy can suspend.

---

[1] Phil. Trans. vol. ii. p. 148.

count read to the literary and Philosophical Society of New York, as having been apparently "aggregated of numerous others, which were likewise composed of smaller ones, while some of more than ordinary size appeared single, as if they had been snow-balls immersed in water, and refrozen."

Hailstones vary considerably in size—from that of a mullet seed to that of a pigeon's egg—the smaller generally falling in the more northern climates, the larger in the south of Europe. Hailstones have fallen in Scotland which have been found to weigh five ounces; in North America they have been picked up weighing fifteen ounces; and in October 5, 1831, one fell at Constantinople which weighed more than a pound.

Hail-storms occur principally in the temperate regions of the globe; they appear less often between the tropics, and may be almost said to be unknown in the frigid zone, where the only substance which falls resembling hail is described by Captain Scoresby as consisting of "a white porous spherical concretion, of a light snowy texture." The reason assigned for the frequency of hail-storms in temperate climates, is, that the air in these regions is often in a high state of electricity, for which reason the hail-showers are, as we have already observed, so frequently accompanied by thunder and lightning. France, owing probably to its situation between the Alps and Pyrenees, is, especially in its southern districts, liable to the most severe and disastrous hail-storms: indeed, the distress they occasioned was so great, that the attention of scientific men was directed to the phenomena of these storms, for the purpose of their suggesting or devising some means to avert, if possible, the calamities they so frequently occasioned. Accordingly, proceeding on the supposition that these hail-storms were occasioned by the unequal distribution and accumulation of electric fluid in the atmosphere, they proposed drawing off the fluid by means of rods, similar to those by which public buildings are protected from the effects of lightning. The Linnæan Society of Paris, after causing numerous experiments to be instituted, ascertained the efficacy of these hail-rods in protecting the adjacent districts from the injuries produced by these storms. In the annals of that society, it is stated, that "the hail-rod, or *paragrêle*, has for several years occasioned much inquiry on the continent, and has engaged the particular attention of that society. In many districts, which were formerly, year after year, devastated by hail, the instrument has been adopted with complete success, while, in neighbouring districts not protected by hail-rods, the crops have been damaged as usual." Furthermore, it has been estimated by this society, from numerous experiments made in different districts, that "if these hail-rods were established through the whole of France, it would occasion an annual saving to the revenue of fifty millions of francs." A curious and ingenious method of averting the recurrence of these formidable storms, was introduced by the Marquis of Cheviers, a naval officer living on his estate at Vaurenard, who, having recollected to have seen the explosion of guns resorted to at sea for the purpose of dispersing stormy clouds, resolved to attempt a similar method to dissipate hail-storms. For this purpose, he made use of boxes of gun powder, which he caused to be fired from the heights on the approach of a storm. This had the happiest effects; and by this means he continued, until his death, to preserve his lands from their ravages, while the neighbouring villages were frequently sadly desolated. He consumed annually for this purpose between 200 and 300 lbs. of mining powder. The inhabitants of the neighbouring communes, convinced of the excellence of the practice, adopted it, as did many others, in which we believe this preventive measure is still had recourse to. In the commune of Fleury, they use a mortar, which carries a pound of gunpowder at a charge, and it is generally upon the heights, and before the clouds have had time to accumulate, that they make the explosions.

In the temperate zones, therefore, meteors are rarely found thus terrible; but between the tropics, and near the poles, they assume very dreadful and various appearances. In those inclement regions, where cold and heat exert their chief power, meteors seem peculiarly to have fixed their residence. They are seen there in a thousand terrifying forms, astonishing to Europeans, yet disregarded by the natives, from their frequency. The wonders of air, fire, and water, are there combined, to produce the most tremendous effects; and to sport with the labour, and apprehensions of mankind. Lightnings, that flash without noise; hurricanes, that tear up the earth; clouds, that all at once pour down their contents, and produce an instant deluge; mock suns; northern lights, that illuminate half the hemisphere; circular rainbows; halos; fleeting balls of fire; clouds reflecting back the images of things on earth, like mirrors; and water-spouts, that burst from the sea, to join with the mists that hang immediately above them. These are but a part of the phenomena that are common in those countries; and from many of which our own climate is, in a great measure, exempted.

The meteors of the torrid zone are different from those that are found near the polar circles; and it may readily be supposed, that in those countries where the sun exerts the greatest force in raising vapours of all kinds, there should be the greatest quantity of meteors. Upon the approach of the winter months, as they are called under the line, which usually begin about May, the sky, from a fiery brightness, begins to be overcast, and the whole horizon seems wrapt in a muddy cloud. Mists and vapours still continue to rise; and the air, which so lately before was clear and elastic, now becomes humid, obscure, and stifling; the fog becomes so thick, that the light of the sun seems in a manner excluded; nor would its presence be known but for the intense and suffocating heat of its beams, which dart through the gloom, and instead of dissipating only serve to increase the mist. After this preparation, there follows an almost continual succession of thunder, rain, and tempests. During this dreadful season, the streets of cities flow like rivers; and the whole country wears the appearance of an ocean. The inhabitants often make use of this opportunity to lay in a stock of fresh water for the rest of the year; as the same cause, which pours down the deluge at one season, denies the kindly shower at another. The thunder which attends the fall of these rains is much more terrible than that we are generally acquainted with. With us, the flash is seen at some distance, and the noise shortly after ensues; our thunder generally rolls in one quarter of the sky, and one stroke pursues another. But here it is otherwise; the whole sky seems illuminated with unremitted flashes of lightning; every part of the air seems productive of its own thunders; and every cloud produces its own shock. The strokes come so thick, that the inhabitants can scarcely mark the intervals; but all is one unremitted roar of elementary confusion. It should seem, however, that the lightning of those countries is not so fatal or so dangerous as with us; since in this case the torrid zone would be uninhabitable.[1]

---

[1] It has been demonstrated by the sagacity of Dr Franklin, that *thunder and lightning* is merely a case of electrical discharges from one portion of the atmosphere to another, or from one cloud to another. Air, and all gases, are non-conductors; but vapour, and clouds, which are composed of it, are conductors. Clouds consist of small hollow bladders of vapour, charged each with the same kind of electricity. It is this electric charge which prevents the vesicles from uniting together, and falling down in the form of rain. Even the vesicular form which the vapour assumes, is probably owing to the particles being charged with electricity. The mutual repulsion of the electric particles may be considered as sufficient (since they are prevented from leaving the vesicle by the action of the surrounding air, and of the surrounding vesicles), to give the vapour the vesicular form.

In what way these clouds come to be charged with electricity, it is not easy to say. But as electricity is evolved during the act of evaporation, the probability is, that clouds are always charged with electricity, and that they owe their existence, or at least their form, to that fluid. It is very probable that when two currents of dry air are moving different ways, the friction of the two surfaces may evolve electricity. Should these currents be of different temperatures, a portion of the vapour which they always contain, will be deposited; the electricity evolved will be taken up by that vapour, and will cause it to assume the vesicular state constituting a cloud. Thus we can see, in general, how clouds come to be formed, and how they contain electricity. This electricity may be either vitreous or resinous, according to circumstances. And it is conceivable, that by long continued opposite currents of air, the charge accumulated in a cloud may be considerable. Now, when two clouds charged, the one with vitreous, and the other with resinous electricity, happen to approach within a certain distance, the thickness of the coating of electricity increases on the two sides of the clouds which are nearest each other. This accumulation of thickness soon becomes so great as to overcome the pressure of the atmosphere, and a discharge takes place, which occasions the flash of lightning. The noise accompanying the discharge constitutes the thunder-clap, the long continuance of which partly depends on the reverberations from neighbouring objects. It is therefore loudest and largest, and most tremendous, in hilly countries.

These electrical discharges obviously dissipate the electricity, the cloud condenses into water, and occasions the sudden and heavy rain which always terminates a thunder-storm. The previous motions of the clouds, which act like electrometers, indicate the electrical state of different parts of the atmosphere.

Thunder then only takes place when the different strata of air are in different electrical states. The

When these terrors have ceased, with which, however, the natives are familiar, meteors of another kind begin to make their appearance. The intense beams of the sun darting upon stagnant waters, that generally cover the surface of the country, raise vapours of various kinds. Floating bodies of fire, which assume different names, rather from their accidental forms than from any real difference between them, are seen without surprise. The *draco volans*, or flying dragon, as it is called; the *ignis fatuus*, or wandering fire; the *fires of St Helmo*, or the mariner's light; are every where frequent: and of these we have numberless descriptions. "As I was riding in Jamaica," says Mr Barbham, "one morning from my habitation, situated about three miles north-west from Jago de la Vega, I saw a ball of fire, appearing to me of the bigness of a bomb, swiftly falling down with a great blaze. At first I thought it fell into the town; but when I came nearer, I saw many

---

clouds interposed between these strata, are also electrical, and owe their vesicular nature to that electricity. They are also conductors. Hence they interpose themselves between strata in different states, and arrange themselves in such a manner as to occasion the mutual discharge of the strata in opposite states. The equilibrium is restored; the clouds, deprived of their electricity, collapse into rain; and the thunder terminates.

In thunder-storms the discharges usually take place between two strata of air, very seldom between the air and the earth. But that they are sometimes also between clouds and the earth cannot be doubted.

These discharges sometimes take place without any noise. In that case the flashes are very bright, but they are single flashes passing visibly from one cloud to another, and confined usually to a single quarter of the heavens. When they are accompanied by the noise which we call *thunder*, a number of simultaneous flashes, of different colours, and constituting an interrupted zigzag line, may generally be observed stretching to an extent of several miles. These seem to be occasioned by a number of successive or almost simultaneous discharges from one cloud to another; these intermediate clouds serving as intermediate conductors, or stepping-stones, for the electrical fluid. It is these simultaneous discharges which occasion the rattling noise which we call thunder. Though they are all made at the same time, yet as their distances are different, they only reach our ear in succession, and thus occasion the lengthened rumbling noise, so different from the snap which accompanies the discharge of a Leyden jar.—*Dr. T. Thomson on Heat and Electricity.*

After Franklin in 1752 had established the identity of lightning and electricity, it was proved by the researches of Walsh, Hunter, and Cavendish, that the torpedo, a fish allied to the rays, possessed a powerful electrical apparatus. In 1790, Galvani showed the existence of electrical currents in the bodies of all animals. In 1800, Davy first employed electricity as an agent in chemical decomposition, and in seven years thereafter its application enabled him to enrich science by the discovery of twelve new metals. The subsequent observations of Oersted, a Dane, and Seebeck of Berlin, established the connection between magnetism and electricity, and between heat and electricity; which was confirmed in France by Ampere and Arago, who discovered the power of an electric current to develope magnetism. Faraday, the greatest electrician of the century, commenced his investigations in 1821, and is the principal founder of the science of magneto-electricity. He was the first to demonstrate the essential identity, in nature and power, of all the different kinds of electricity previously examined. In 1845 he proved the subjection of light to electrical influence; and subsequently gave to the scientific world a succession of observations on the magnetic condition of matter universally. From this period electrical science began to assume a character of the highest practical interest, the foundation having been laid for the greatest discovery of the age—the Electric Telegraph. Many attempts had been made to render frictional electricity available for telegraphic purposes; but it was not till the discovery, in 1820, by Professor Oersted, that the compass needle is deflected from its usual direction by an electric current flowing in a course parallel to it, that the true principle of this great practical attainment was indicated. This important fact formed the basis of several schemes for a telegraph, and, among others, for that of Wheatstone and Cooke, which was patented in 1837. Various instruments and processes are now in operation, the invention having been brought to a high state of efficiency in a surprisingly short time. Within the same brief space the electric telegraph has been adopted throughout a large portion of the civilized world, all the nations of which, probably before the lapse of as many years more, will be comprehended in one unbroken system of communication by land and sea.

Electricity is also applied to purposes of use and ornament in the art of electro-metallurgy, which owes its origin to the discovery of the voltaic pile, and is chiefly the growth of the last few years. The process consists in passing a current of electricity through a solution of a metal, and thus causing its deposition upon objects introduced into the solution. Moulds of wax or plaster, casts of natural objects, medals, coins, and busts, are in this way coated with the metal held in solution; silver is plated with gold, iron is coated with copper or zinc. The process admits of innumerable applications, some of which are of great practical value in the arts and manufactures. Electricity is made available also in the cure and alleviation of disease. The danger arising from atmospheric electrical discharges led, at an early stage in the progress of the knowledge of this subtle and resistless force, to the use of lightning conductors on elevated buildings. The thunder-rod does not attract lightning; it only conducts it directly and safely to the earth when it strikes a building. Faraday has shown that the rods should be of considerable dimensions, as a thin rod presents so much resistance as not to prevent lateral discharges of a destructive kind. At the same time the rod serves as a protection only within a few feet of its position, unless it be connected with the whole roof of a building by strips of metal of sufficient size. In H.M.S. *Endymion*, the mainmast was protected by a rod, the foremast not; and a flash of lightning striking the latter shivered it to pieces. Under the direction of Sir W. Snow Harris, an efficient substitute for the ordinary lightning conductor has lately been introduced into ships, where a continuous rod connected with the masts was impracticable. Along the entire length of each mast he inlays a slip of copper; and these slips are so arranged that whatever the elevation or depression of the mast, a complete metallic contact is maintained betwixt the adjacent ones, and the lower part of the conductor terminates in the sea. Many ships have already been preserved from destruction by this ingenious contrivance.

people gathered together, a little to the southward, in the savanna, to whom I rode up, to inquire the cause of their meeting: they were admiring, as I found, the ground's being strangely broke up and ploughed by a ball of fire, which, as they said, fell down there. I observed there were many holes in the ground; ne in the middle, of the bigness of a man's head, and five or six smaller round about it, of the bigness of one's fist, and so deep as not to be fathomed by such implements as were at hand. It was observed, also, that all the green herbage was burned up, near the holes; and there continued a strong smell of sulphur near the place, for some time after."

Ulloa gives an account of one of a similar kind, at Quito.[1] "About nine at night," says he, "a globe of fire appeared to rise from the side of the mountain Pichinca, and so large, that it spread a light over all the part of the city facing that mountain. The house where I lodged looking that way, I was surprised with an extraordinary light, darting through the crevices of the window-shutters. On this appearance, and the bustle of the people in the street, I hastened to the window, and came in time enough to see it, in the middle of its career; which continued from west to south, till I lost sight of it, being intercepted by a mountain, that lay between me and it. It was round; and its apparent diameter about a foot. I observed it to rise from the sides of Pichinca; although, to judge from its course, it was behind that mountain where this congeries of inflammable matter was kindled. In the first half of its visible course, it emitted a prodigious effulgence, then it began gradually to grow dim; so that, upon its disappearing behind the intervening mountain, its light was very faint."

Meteors of this kind are very frequently seen between the tropics; but they sometimes, also, visit the more temperate regions of Europe. We have the description of a very extraordinary one, given us by Montanari, that serves to show to what great heights, in our atmosphere, these vapours are found to ascend. In the year 1676, a great globe of fire was seen at Bononia, in Italy, about three quarters of an hour after sun-set. It passed westward, with a most rapid course, and at the rate of not less than a hundred and sixty miles in a minute, which is much swifter than the force of a cannon-ball, and at last stood over the Adriatic sea. In its course it crossed over all Italy; and, by computation, it could not have been less than thirty-eight miles above the surface of the earth. In the whole line of its course, wherever it approached, the inhabitants below could distinctly hear it, with a hissing noise, resembling that of a firework. Having passed away to sea, towards Corsica, it was heard, at last, to go off with a most violent explosion, much louder than that of a cannon: and, immediately after, another noise was heard, like the rattling of a great cart upon a stony pavement; which was, probably, nothing more than the echo of the former sound. Its magnitude, when at Bononia, appeared twice as long as the moon, one way, and as broad the other; so that, considering its height, it could not have been less than a mile long, and half a mile broad. From the height at which this was seen, and there being no volcano on that quarter of the world from whence it came, it is more than probable that this terrible globe was kindled on some part of the contrary side of the globe, in those regions of vapours which we have been just describing; and thus, rising above the air, and passing in a course opposite to that of the earth's motion, in this manner it acquired its amazing rapidity.

To these meteors, common enough southward, we will add one more of a very uncommon kind, which was seen by Ulloa, at Quito, in Peru; the beauty of which will, in some measure, serve to relieve us, after the description of those hideous ones preceding. "At day break," says he, "the whole mountain of Pambamarca, where we then resided, was encompassed with very thick clouds; which the rising of the sun dispersed so far, as to leave only some vapours, too fine to be seen. On the side opposite to the rising sun, and about ten fathoms distant from the place where we were standing, we saw, as in a looking-glass, each his own image; the head being, as it were, the centre of three circular rainbows, one without the other, and just near enough to each other as that the colours of the internal verged upon those more external; while round all was a circle of white, but with a greater space between. In this manner these circles were erected, like a mirror, before us; and as we moved, they moved, in disposition and order. But, what is most remarkable, though we were six in number, every one saw the phenomenon with regard to himself, and not that relating to others. The diameter of the arches gradually altered, as the sun rose above the horizon; and the whole, after continuing a long time, insensibly faded away. In the beginning, the diameter of the inward iris, taken from its last colour, was about five degrees and a half; and that of the white arch, which surrounded the rest, was not less than sixty-seven degrees. At the beginning of the phenomenon, the arches seemed of an oval or elliptical figure, like the disc of the sun; and afterwards became perfectly circular. Each of these was of a red colour, bordered with an orange; and the last bordered by a bright yellow, which altered into a straw colour, and this turned to a green; but, in all, the external colour remained red." Such is the description of one of the most beautiful illusions that has ever been seen in nature. This alone seems to have combined all the splendours of optics in one view. To understand the manner, therefore, how this phenomenon was produced, would require a perfect knowledge of optics; which it is not our present province to enter upon. It will be sufficient, therefore, only to observe, that all these appearances arise from the density of the cloud, together with its uncommon and peculiar situation, with respect to the spectator and the sun. It may be observed, that but one of these three rainbows was real, the rest being only reflections thereof. It may also be observed, that whenever the spectator stands between the sun and a cloud of falling rain, a rainbow is seen, which is nothing more than the reflection of the different coloured rays of light from the bosom of the cloud. If, for instance, we take a glass globe, filled with water, and hang it up before us opposite the sun, in many situations it will appear transparent; but if it is raised higher, or sideways, to an angle of forty-five degrees, it will at first appear red; altered a very little higher, yellow; then green, then blue, then violet colour: in short, it will assume successively all the colours of the rainbow; but, if raised higher still, it will become transparent again. A falling shower may be considered as an infinite number of these little transparent globes, assuming different colours, by being placed at their proper heights. The rest of the shower will appear transparent, and no part of it will seem coloured; but such as are at angles of forty-five degrees from the eye, forty-five degrees upward, forty-five degrees on each side, and forty-five degrees downward, did not the plane of the earth prevent us. We therefore see only an arch of the rainbow, the lower part being cut off from our sight by the earth's interposition. However, upon the tops of very high mountains, circular rainbows are seen, because we can see to an angle of forty-five degrees downward, as well as upward, or sideways, and therefore we take in the rainbow's complete circle.

---

[1] Ulloa, vol. i. p. 41.

In those forlorn regions round the poles, the meteors, though of another kind, are not less numerous and alarming. When the winter begins, and the cold prepares to set in, the same misty appearance which is produced in the southern climates by the heat, is there produced by the contrary extreme.[1] The sea smokes like an oven, and a fog arises which mariners call the *frost smoke.* This cutting mist commonly raises blisters on several parts of the body; and as soon as it is wafted to some colder part of the atmosphere, it freezes to little icy particles, which are driven by the wind, and create such an intense cold on land, that the limbs of the inhabitants are sometimes frozen, and drop off.

There, also, halos, or luminous circles round the moon, are oftener seen than in any other part of the earth, being formed by the frost smoke; although the air otherwise seems to be clear. A lunar rainbow also is often seen there, though somewhat different from that which is common with us; as it appears of a pale white, striped with gray. In these countries also, the aurora borealis streams with peculiar lustre, and variety of colours.[2] In

---

[1] Paul Egede's History of Greenland.

[2] The aurora borealis is one of the most striking and splendid spectacles in the heavens. In the temperate latitudes it appears as a faint, beautiful yellow light, like the morning or evening twilight. It generally rises from a kind of dark cloud, or collection of vapours, which runs along from the north to the east and west, through 50°, 100°, and sometimes 150°, with an even edge, elevated 15° or 50° above the horizon. Sometimes it is perpetually changing its altitude, and seems to roll like the sea in a storm. The luminous matter immediately above this cloud is pretty steady and uniform. But from this there are streams that dart up towards the zenith with great rapidity. These are suddenly extinguished and renewed, and continually shift their places; sometimes they rise only a few degrees and with a faint light, at other times they mount in a broad and bright beam to the zenith. Ordinarily the streams do not rise more than 50° or 60°. They often resemble the tail of a comet, being more condensed at the point from which they issue, and growing fainter as they ascend. Sometimes they extend to the zenith, forming a beautiful canopy of luminous wreaths, like the curling flames that meet at the top of an oven.

Besides this variable, undulating light in the north, there is sometimes seen a broad permanent arch from 15° to 20° wide, rising from the magnetic east, and passing near the zenith at right angles to the direction of the streamers. In some instances it has been observed to have a slow motion, and to throw out small coruscations to the north. It breaks up gradually and by piecemeal, sometimes leaving faint yellow clouds occupying the place of it.

The absolute height of this arch, on account of its definiteness and permanency, is more easily computed than that of the other lights. It has been estimated at from fifty to seventy miles above the surface of the earth. The height of other parts of an aurora borealis is much more uncertain. It has been differently estimated by different persons. Some have supposed it to be nearly a thousand miles, while others have made it only fifty or a hundred. The latest and best observations have reduced it to about a hundred and fifty.

The duration of this light is generally in proportion to its intensity and extent. Sometimes it continues only for a few minutes. It is frequently observed in a greater or less degree during most of the night; and, in some instances, it has lasted several days, and even a week, without interruption.

Mr Dalton, a distinguished meteorologist, who has paid particular attention to this subject, observes, that the appearances of an aurora borealis come under four different descriptions. First, a horizontal light like that

Greenland it generally arises in the east, and darts its sportive fires, with variegated beauty, over the whole horizon. Its appearance is almost constant in winter; and at those seasons when the sun departs to return no more for half a year, this meteor kindly rises to supply its beams, and affords sufficient light for all the purposes of existence. However, in the very

---

of the morning. Secondly, fine, slender, luminous beams directed toward the zenith, in arcs of great circles; well defined, and of a dense light; sometimes apparently at rest, but oftener with a quick lateral motion, and of a duration from 15′ to 1′. Thirdly, flashes following the direction of the beams, but more diffuse, and of a weaker light, and growing fainter as they ascend, without a horizontal motion, sudden and momentary in their appearance, and repeated many times in a minute. Fourthly, arches nearly in the form of a rainbow, crossing the beams at right angles, and being concentric with the more permanent horizontal light, and tending towards the same points.

The disturbance of the magnetic needle, produced by an aurora borealis, which had been frequently observed, was particularly attended to by Mr Dalton.

When the aurora borealis appears to rise only about 5°, or 10°, or 15° above the horizon, the disturbance of the needle, he says, is very little, and often insensible. When it rises to the zenith and passes it, there never fails to be a considerable motion. This disturbance consists in an irregular oscillation of the horizontal needle, sometimes to the eastward, and then to the westward of the mean daily position, in such sort that the greatest excursions on each side are nearly equal, and amount to about half a degree each in England. When the aurora ceases, or soon after, the needle returns to its former station.

Mr Dalton endeavoured also to ascertain, whether the aurora borealis had any connection with the tides in our atmosphere, consequent upon the motions of the moon; and according to his observations, continued for about six years, the average number of auroræ during the period of spring tides, exceeded the number that happened during the period of neap tides, by about one fourth.

It appeared also from the same observations, that this phenomenon occurred much more frequently at the time of the equinoxes, when the tides are highest, than at the solstices, when they are lowest. But the period of most frequent occurrence seems to extend through the spring and fall months, and to have very little correspondence with the annual tides. The months most favourable to the phenomenon, as exhibited in these results, are April and November, and the least favourable July and December.

But one of the most remarkable circumstances attending this phenomenon, is that it sometimes does not appear for many years together. It is but a little more than a century since it has been so frequent and conspicuous as to attract any considerable attention. No appropriate name was given to it by the ancient philosophers, and no very distinct account of it is to be found among their writings. In the book of Job, we read, "Men see not the bright light which is in the clouds, but the wind passeth and cleanseth them. Fair weather cometh out of the north: with God is terrible majesty." The original word here rendered *fair weather*, answers to the Latin word *aurum*, which is used figuratively for almost any thing of a bright, gold colour, and especially for the light of the sun and other celestial phenomena. It will certainly bear to be rendered *a yellow light*, as well as *fair weather;* and considered as referring to the aurora borealis, it agrees much better with the succeeding part of the verse, "with God is terrible majesty." Fair weather is rather emblematical of mildness and benignity than of terror, and with what propriety can it be said to come from the north? We do not know that there are any meteorological appearances in Oriental countries to warrant this construction.

Seneca, in treating of thunder and lightning, speaks of the air being inflamed by motion, and being converted into fire; but whether with any reference to the aurora borealis, is not certain. In speaking of comets, however, he says, that "the common opinion with us is, that these meteors in the form of trumpets and beams, and other uncommon appearances in the heavens, *alia ostenta cæli*, are composed of dense vapours; and the reason why they appear most frequently in the north is, that there is more dark vapour there." Pliny speaks of most meteors appearing *sub ipsa septentrione;* and Aristotle, of their originating in the north. Now, although the name of comets is given to these appearances by Aristotle, and, indeed, sometimes by Pliny, yet, as it cannot be supposed that this region was more frequented by comets formerly than it is now, it is highly probable, that the aurora borealis was comprehended in the same class, its appearance being very similar to the tails of some comets; and that fire-balls and shooting stars were included, is evident from what Aristotle says of comets disappearing without setting. We have also accounts, by historians, of luminous appearances in the heavens under the name of *comets*, or the more general one of *portenta*, which answer much better to an aurora borealis, than to any comet of modern times. Justin relates, that a comet appeared about 122 years before the Christian era, that filled about one fourth part of the heavens with its light, and that it occupied four hours in rising and setting. About 150 years before, we are told that a comet was seen, which spread itself like a forest over a third part of the heavens. We think, therefore, that the aurora borealis was known to the ancients, but was confounded with other phenomena, all of which were indistinctly described, and often probably much exaggerated.

Still it is very surprising, that after the revival of letters, and after the spirit of observation and inquiry had begun to be awakened, we meet with no record of any such phenomenon, till about two centuries and a half ago. The earliest account, in English, relates to one that appeared in 1560. From this time they happened frequently for about ten years. For the next forty years there are none on record. From 1620, for two or three years there were several remarkable ones, and then no more for eighty years. This brings us down to the commencement of the eighteenth century, during which they have appeared at irregular intervals.

That the aurora borealis is not a recent, temporary light, but is to be referred to permanent causes and the physical constitution of our globe and its atmosphere, is rendered the more probable from the constancy and very great splendour with which it presents itself to the benighted inhabitants of the polar regions. The account which we have given, it is to be recollected, is borrowed principally from observations that were made in the more cultivated parts of Europe, where it is not only of rare occurrence, but, for the most part, incomplete, feeble, and imperfect. As we approach the polar circle we are greeted with this light almost as regularly as with the light of the milky way, and it is welcomed as gladly as that of the moon. Maupertuis, who, with several others, went to measure an arc of the meridian on the confines of the frigid zone, continued to prosecute his nice and difficult work by the aid of this light, long after the sun had left him. He says, that it is sufficient, together with the light of the heavenly bodies, for most of the occasions of life. "No sooner are the short days closed," he continues, "than fires of a thousand figures and colours light the sky, as if intended to make up for midst of their tedious nights, the inhabitants are not entirely forsaken. The tops of the mountains are often seen painted with the red rays of the sun; and the poor Greenlander from thence begins to date his chronology. It would appear whimsical to read a Greenland calendar, in which we might be told, That one of their chiefs, having lived forty

---

the absence of the sun. These lights are perpetually varying. Sometimes they begin in the form of a great scarf of bright light, with its extremities upon the horizon, which, with a motion resembling that of a fishing-net, glides swiftly up the sky, preserving a direction nearly perpendicular to the meridian; and commonly, after these preludes, all the lights unite at the zenith and form the top of the crown. The motion of these meteors is commonly that of two standards waving in the air, and the different tints of their light give them the appearance of so many streamers of changeable silk." "I saw," says the same observer, "a phenomenon of this kind that, in the midst of all the wonders to which I was now every day accustomed, excited my admiration. To the south a great space of sky appeared, tinged with so lively a red, that the constellation of Orion looked as if it had been dipped in blood. This light, which was at first stationary, soon moved, and changing into other colours, violet and blue, settled into a dome, the top of which stood a little to the south-west of the zenith. In this country, where there are lights of so many different colours, I never saw but two that were red, and such are always taken for presages of some great misfortune."

In the northern districts of Siberia, according to the description of Gmelin, cited and translated by Dr Blagden, the aurora is observed to begin with single bright pillars, rising in the north, and almost at the same time in the north-east; which, gradually increasing, comprehend a large space of the heavens, rush about from place to place with incredible velocity, and finally almost cover the whole sky up to the zenith, and produce an appearance as if a vast tent was expanded in the heavens, glittering with gold, rubies, and sapphire. A more beautiful spectacle cannot be painted. But, whoever should see such a northern light for the first time, could not behold it without terror. For, however fine the illumination may be, it is attended, as I have learned from the relation of many persons, with such a hissing, crackling, and rushing noise through the air, as if the largest fireworks were playing off. To describe what they then hear, they make use of an expression, which signifies "the raging host is passing." The hunters who pursue the white and blue foxes in the confines of the icy sea, are often overtaken in their course by these northern lights. Their dogs are then so much frightened that they will not move, but lie obstinately on the ground till the noise has passed.

The remarkable noise which, in this account, is said to attend the aurora borealis, deserves particular attention. It has been noticed by others, particularly by persons at Hudson's Bay, and by the Greenland whale-fishers. Something of the kind has been perceived also in lower latitudes. Mr Cavallo declares that he has repeatedly heard a crackling sound, proceeding from an aurora. Mr Nairne, the electrician, states with great confidence that, at a time when the northern lights were very remarkable in England, they were attended with a hissing or whizzing sound. Dr Belknap, in his account of these lights as they appeared in New Hampshire in 1719, says, "In a calm night, and in the intervals between the gentle flaws of wind, an attentive ear, in a retired situation, may perceive it to be accompanied by a sound like that made by a silk handkerchief rubbed along the edge by a quick motion of the thumb and finger."

In confirmation of the same point, and in proof of the near approach of these lights to the surface of the earth, we will here state what appeared in an American newspaper a few years ago, attested by three very respectable persons. We are there informed, that an aurora borealis appeared at Hartford, in the state of Vermont, with its base elevated but a few degrees above the horizon, lying in a regular line, very bright, and not much wider than the rainbow; above this, in several places, streams shot up towards the zenith, as usual. "We had not viewed it long," they continue, "before we observed the eastern part of it had settled so low, as actually to be between us and the highland on the north side of White River, at the distance from us, perhaps, of about one mile and a half. The meteor, we apprehended, must have been nearly perpendicular to White River, and distant about half a mile."

We have now mentioned the principal phenomena respecting these lights as they show themselves in this hemisphere. We know very little of those which appear about the south pole. They presented themselves to Captain Cook, when he had proceeded as far as latitude 58°. They consisted of long columns of a clear white light, shooting up from the horizon to the eastward, almost to the zenith, and gradually spreading over the whole southern part of the sky. These columns were sometimes bent sideways at their upper extremities, and though in most respects similar to the northern lights, yet they differed from them in being always of a whitish colour.

We have already been so long occupied with this detail of facts, that we have now little space left to discuss the opinions that have been proposed in explanation of the origin and nature of the phenomenon. According to Dr Halley, the northern lights proceed from sulphureous, self-luminous vapours, that rise out of the bowels of the earth. According to Euler, they are the reflection of the sun's light from particles of the condensed polar atmosphere, carried off to the distance of a thousand miles, or more, from the earth, by the impulse of the solar rays, and are of the nature of a comet's tail. According to Mairan, who wrote a full treatise on this subject, they are portions of the sun's atmosphere driven from the earth's equator toward the poles by the centrifugal force, and consist of the same substance as the zodiacal light. According to Monge, they are light clouds illuminated by the rays of the sun that have undergone several reflections successively from different strata of clouds. None of these hypotheses furnishes any explanation of the motions of the magnetic needle which are observed to attend an aurora, or of the regular rainbow-like arches, which cross the magnetic meridian at right angles, or of the noises that are so well attested, and so remarkable, particularly in high latitudes.

According to Kirwan, these lights arise from the combustion of hydrogen gas set on fire by electricity. According to Mr Libes, they are the fumes of nitric acid or nitrous acid, formed in the atmosphere by the union of oxigen and azote. Each of these suppositions, if indeed it would account for the noises that are heard, fails of giving any solution of the magnetic phenomena of the aurora borealis.

The most plausible theory seems to be that which gives to the northern and southern lights an electrical origin. The appearance of the light itself is very similar to that which is produced by sending the electric fluid through a portion of air rarefied to the same degree as that in the upper regions of the atmosphere. The rapidity of the motions that are observed in the light and beautiful streams that play from the horizon to the zenith, and dart through this space in a few seconds, days, died, at last, of a good old age; and that his widow continued for half a day to deplore his loss, with great fidelity, before she admitted a second husband.

The meteors of the day, in these countries, are not less extraordinary than those of the night: mock suns are often reflected upon an opposite cloud; and the ignorant spectator fancies that there are often three or four real suns in the firmament at the same time. In this splendid appearance the real sun is always readily known by its superior brightness, every reflection being seen with diminished splendour. The solar rainbow there, is often seen different from ours. Instead of a pleasing variety of colours, it appears of a pale white, edged with a stripe of dusky yellow: the whole being reflected from the bosom of a frozen cloud.[1]

But of all the meteors which mock the imagination with an appearance of reality, those strange illusions that are seen there, in fine serene weather, are the most extraordinary and entertaining. "Nothing," says Crantz, "ever surprised me more, than on a fine warm summer's day, to perceive the islands that lie four leagues west of our shore, putting on a form quite different from what they are known to have. As I stood gazing upon them, they appeared at first infinitely greater than what they naturally are; and seemed as if I viewed them through a large magnifying glass. They were not thus only made larger, but brought nearer to me. I plainly described every stone

---

answers to no power with which we are acquainted so well as to electricity. The rustling noises, so irreconcileable with other hypotheses, have been expressly compared, without reference to any theory, to those which attend the passage of electricity through the air. It is asked, how the electric fluid is accumulated at the poles? We answer, it may be carried there in vapour that rises from the neighbouring seas, just as it is carried into the neighbouring parts of our atmosphere; when this vapour is precipitated in rain and snow, the electricity it contained is prevented from diffusing itself through the earth, on account of the ice which covers these regions, and which, with the degree of cold that prevails there, becomes a non-conductor. The electricity, therefore, being prevented from finding its equilibrium through the earth, will, when condensed to a certain degree, restore itself by forcing a passage through the higher parts of the atmosphere.

It is moreover believed by some philosophers, that an extremely subtile elastic fluid, of a ferruginous nature, or at least such as is capable of being acted upon magnetically, exists in the higher regions of the atmosphere; that this fluid is collected into parallel cylindrical beams and horizontal rings by virtue of the earth's magnetism, and that the beams and rings are preserved in their due form and position, and distinct from each other, by their magnetic attraction. This fluid is supposed to be an imperfect conductor of electricity. When the electricity of the upper regions of the atmosphere is disturbed, it is supposed that the electric fluid runs along these beams and rings from one part of the atmosphere to another to restore the equilibrum. The reason why the diffuse flashes succeed the more intense light of the beams is, it is thought, because the electricity disperses the elementary particles of the beams in some degree, which collect again after the electric circulation has ceased. Hence too the reason of the fluctuations of the magnetic needle on the earth's surface, while the magnetism of the upper regions of the atmosphere is thus affected.

The streamers seem to converge toward a point more or less distant from the zenith; and sometimes apparently meet, forming, as we have said, what is called a crown. This point is that toward which the dipping needle is directed; and the convergency is a mere perspective effect, like the convergency of rows of trees, of pillars, or of lights on a long street or bridge. The same phenomena are perceived also in the rays of the sun issuing at a small opening in a cloud. The apparent point of meeting are the most distant point, and the seemingly near approach is the simple and necessary effect of greater distance. The whole form of the sky indeed, and of every thing that is painted on the celestial vault, is an optical deception. The streams, therefore, that seem tapering and tending more and more to a point, as they ascend, are to be considered as cylindrical and parallel beams that have the same position as the magnetic dipping needle. This circumstance, moreover, comes in aid of what has already been said as to the source of electricity that is supposed to pass along the columns of magnetic particles. The different strata of the atmosphere are found to be in different states of electricity, the vitreous or positive electricity increasing as we ascend. Hence toward the poles, where the columns, or dipping needle, is most perpendicular, the extremities of a column are in portions of the atmosphere that differ most in their electrical states; whereas in approaching the equator, we find the magnetic columns more and more tending to a horizontal position, and consequently less likely to afford a passage to the electric fluid, since the extremities, in this case, will fall into strata of the atmosphere that differ less in their state of electricity. It is admitted that there is a good deal in this theory that has never yet been satisfactorily proved, and a good deal that still remains unexplained.

[1] The cause of the variety of colours exhibited by the rainbow, was not understood until Sir Isaac Newton had demonstrated the composition of light. It is now known that a single white solar beam consists of several different coloured rays, which, combined together, produce the white light. According to Sir Isaac Newton's discovery, there are seven primary rays, of the following colours: red, orange, yellow, green, blue, indigo, violet. But recently Sir David Brewster has shown that four of these seven coloured rays are compounded of the three others. Thus the intermixture of the red and yellow rays produces the orange-coloured ray—the combination of the yellow and blue produces the intermediate green—and the combination of the red with the blue produces the indigo and violet rays. Properly speaking, therefore, there are only three primary rays in a sunbeam—the red, yellow, and blue; and these, by certain degrees of intermixture, produce the seven distinct colours referred to by Sir Isaac Newton. It is elsewhere shown that a cloud consists of a vast number of watery globules, which float together in the regions of the atmosphere. When such a cloud opposite the sun is falling in rain, the spectator, having his back turned to the sun, beholds a reflected arch of light of many hues: for the white rays of light, having been decomposed by the watery globules, exhibit these varied colours. Sometimes, instead of forming a complete semicircle, spanning the azure vault, only a part, or segment, of the arch appears. Not unfrequently two rainbows are seen at the same time, and as many as six, seven, and even eight, have been simultaneously observed. The rainbows of

upon the land, and all the furrows filled with ice, as if I stood close by. When this illusion had lasted for a while, the prospect seemed to break up, and a new scene of wonder to present itself. The island seemed to travel to the shore, and represented a wood, or a tall cut hedge. The scene then shifted, and showed the appearance of all sorts of curious figures; as ships with sails, streamers, and flags; antique elevated castles, with decayed turrets: and a thousand forms, for which fancy found a resemblance in nature. When the eye had been satisfied with gazing, the whole group of riches seemed to rise in air, and at length vanish into nothing. At such times the weather is quite serene and clear; but compressed with such subtile vapours, as it is in very hot weather; and these appearing between the eye and the object, give it all that variety of appearances which glasses of different refrangibilites would have done." Mr Crantz observes, that commonly a couple of hours afterwards a gentle west wind and a visible mist follow, which put an end to this *lusus naturæ*.

It were easy to swell this catalogue of meteors with the names of many others, both in our own climate and in other parts of the world. Such as falling stars,[1] which are thought to be no more than unctuous vapours, raised from the earth to small heights, and continuing to shine till that matter which first raised and supported them, being burnt out,

---

Greenland are frequently of a pale white, fringed with a brownish yellow; arising from the rays of the sun being reflected from a frozen cloud. In Iceland it is called the Bridge of the Gods; and the Scandinavians gave it for a guardian a being called Heindaller. They supposed it to connect heaven with earth. Ulloa and Bouguer describe circular rainbows, which are frequently seen on the mountains, rising above Quito, in the kingdom of Peru; while Edward asserts, that a rainbow was seen near London, caused by the exhalations of that city, after the sun had set more than twenty minutes. Rainbows are occasionally produced by the moon's rays being in like manner reflected and refracted from a falling cloud; but such rainbows are not of very frequent occurrence, and the arch they form is generally very pale and indistinct. The rays of the sun falling on the spray of billows, or on the vapours of vast cataracts, produce frequently the appearance of rainbows. This, amidst all its terrors and sublimity, throws a kind of fearful beauty on the waters of Niagara.

[1] In the 'Annuaire,' a French almanac, for 1836, M. Arago, a distinguished astronomer, has the following observations on *falling* or *shooting stars*. These phenomena (he says) which have often been considered unworthy of investigation, and regarded simply as atmospheric meteors originating in the inflammation of a quantity of hydrogen gas, have, in consequence of recent observations, become objects of greater attention among men of science. Previous theories limited their place in the heavens to our own atmosphere; but from observations made at Breslau, and other places, by Professor Brandes and several of his pupils, the height of some shooting stars has been calculated at 500 English miles; and the rate at which they move not less than thirty-six miles in a second, which is nearly double the rate of the earth's motion round the sun. If a reduction be made to one-half of this rate per second, in order to allow for the illusion occasioned by the motion of the earth, the real motion would be eighteen miles per second, which, with the exception of the earth, would still be more rapid than that of any of the principal bodies of our system. In the attempts which have been made to ascertain the apparent direction in which shooting stars usually move, it has been ascertained, that although they become ignited in our atmosphere, they come from beyond it. It is singular that their general direction should be contrary to that in which the earth moves in its annual orbit; and it is much to be desired that the inferences already deduced should be corrected or confirmed by a greater number of observations. We think that the officers of the watch on board the Bonita, (a French vessel on a voyage of discovery,) should be invited, during their voyage of discovery, to note the hour of the appearance of each shooting star, its angular height above the horizon, and especially the direction in which it moves. In referring these meteors to the principal stars of the constellations which they traverse, the different questions here raised can be easily settled.

The means of accounting for the extraordinary appearance of luminous projectiles observed in America in the night of November 12th, and 13th, 1833, are not very satisfactory, unless it be assumed that, besides the planetary bodies which revolve round the sun, there are myriads of smaller bodies which only become visible at the moment when they come within our atmosphere and assume a meteoric appearance; and that these asteroïdes (to use the term which Herschel formerly applied to Ceres, Pallas, Juno, and Vesta) move in groups; and that they move singly also. A careful observation of shooting stars is the only means of enlightening us on this curious subject.

The shooting stars in America, to which allusion has been made, were observed in 1833. They succeeded each other at such short intervals that it was impossible to count them; and the most moderate calculations fixed their number at *hundreds of thousands*. They were so numerous, and showed themselves in so many quarters of the heavens at the same time, that the attempts to estimate them were only rough guesses. At the Observatory at Boston their number was considered to equal one-half of the flakes which fill the air in an ordinary fall of snow. When their numbers were diminishing, 650 stars were counted in fifteen minutes, in a circumscribed part of the heavens, which did not comprise a tenth part of the visible horizon; and these did not amount to more than two-thirds of the whole number seen, which was at least 866; and if the whole hemisphere could have been surveyed by one observer, the number seen would have been 8660, or 36,640 per hour. As the phenomena continued more than seven hours, the number of shooting stars visible at Boston was upwards of 240,000; and it should be recollected that the basis of this calculation was taken when the intensity of the phenomenon was diminishing. It was visible along the whole of the eastern coast of North America, from the gulf of Mexico to Halifax, from nine o'clock in the evening to sunrise, and in some places in full daylight, at eight o'clock in the morning. All these meteors came from the same point of the heavens, viz. γ of Leo, and those which were seen elsewhere was the effect of the earth's movement which caused an apparent alteration in the position of this star. The above facts are certainly very curious, but the following are not less so.

The shooting stars observed in the United States appeared in the night of the 12th and 13th of November. In 1799 a similar phenomenon was observed in America they fall back again to the earth with extinguished flame. Burning spears, which are a peculiar kind of aurora borealis; bloody rains, which are said to be the excrements of an insect, that at that time has been raised into the air. Showers of stones, fishes, and ivy-berries, at first, no doubt, raised into the air by tempests in one country, and falling at some considerable distance, in the manner of rain, to astonish another.[1] But omitting these, of which we know little more than what is thus briefly mentioned, I will conclude this chapter with the description of a water-spout: a most surprising phenomenon, not less dreadful to mariners than astonishing to the observer of nature.

These spouts are seen very commonly in the tropical seas, and sometimes in our own. Those seen by Tournefort, in the Mediterranean, he has described as follows: "The first

---

by M. de Humboldt, in Greenland by the Moravian Brethren, and in Germany by various individuals; and the period of its appearance was also the night of the 12th and 13th of November. In 1832, in Europe and some parts of Asia, the phenomenon was witnessed; and the date was still the night of the 12th and 13th of November. This identity of dates induces us to urge upon our young seamen the task of observing with attention the appearances in the firmament between the 10th and 15th of November. Since my report has been read to the academy, M. Berard, one of the most intelligent officers of the French marine, has favoured me with the subjoined extract from the journal of the brig Loiret, which he commands:—"The 13th of November, 1831, at four o'clock in the morning, the sky being perfectly cloudless, and a copious dew falling, we have seen a number of shooting stars and luminous meteors of great dimensions. During upwards of three hours more than two per minute were seen. One of these meteors, which appeared in the zenith, left an immense train from east to west like a luminous band, and in it many of the colours of the rainbow were distinctly visible; its breadth was equal to one-half of the moon's diameter, and the light which it gave did not disappear for six minutes. We were on the coast of Spain near Carthagena."

On the 13th of November, 1835, a large and brilliant meteor fell near Belley, in the department of the Ain, and set fire to a farm-yard. In the same night of the 13th of November a shooting star, larger and more brilliant than Jupiter, was observed at Lille by M. Delezenne. It left on its passage a shower of sparks precisely similar to those which follow a sky-rocket.

The facts we have now given confirm more and more the existence of a zone composed of myriads of small bodies, whose orbits come within the limits of the earth's ecliptic every year between the 11th and 13th of November. This is a new planetary world which begins to open to us. It is almost unnecessary to state how highly important it is to ascertain if other masses of asteroïdes do not come within the earth's ecliptic at other points than that which it reaches about the 12th of November. It is desirable to make observations between the 20th and 24th of April, as well as in November; for in 1803, on the 22nd of April, I believe, from one o'clock in the morning until three, shooting stars were seen in all directions in such great numbers, in Virginia and Massachusetts, as to be compared to a shower of sky-rockets. Messier states that on the 17th of June, 1777, towards noon, he saw in the space of five minutes a very large number of black globules pass over the sun's disc. Were not these globules also asteroïdes?

[1] Mr Howard, an able English chemist, was among the first to prosecute the study of meteorolites. He collected specimens of stones which had fallen at different times, and in various places. His researches led to the important conclusion, that they are all composed of the same principles, and in nearly the same proportions. This remarkable circumstance has since been proved by the investigations of philosophers of the highest authority, both in chemistry and mineralogy. A thin crust, of a deep black colour, covers the whole of them. They have no gloss, and the surface is roughened with small asperities. When broken, they are internally of a greyish colour, and are of a granulated texture, amongst which, four different substances can be discovered by a lens. Those which occur most frequently vary from the size of a pin's head to that of a pea. They are of a greyish colour, sometimes inclining to brown; opaque, with a little lustre, and capable of giving faint sparks with steel. The second kind is of a reddish yellow colour, and black when powdered. A third consists of small particles of iron, in a perfectly metallic state. From the presence of these, the mass possesses the quality of being attracted by the magnet. The fourth is in general of an earthy consistence, and crumbles when pressed between the fingers. These bodies are composed of iron and nickel, both in a metallic and oxidized state; sulphur, silex (an earth,) magnesia, and about one per cent. of chrome.

The chronicles of almost every age and country record the fall of these bodies. The Chinese and Japanese noted down with great care every thing connected with the appearance of these extraordinary phenomena. The Chinese actually made catalogues of them, believing they were connected with contemporary events. There is no occasion for laughing at this oriental superstition, since there were not wanting, half a century ago, philosophers in enlightened Europe, who declared the impossibility of stones falling from the atmosphere at all.

One of the most remarkable cases of antiquity is that mentioned by Pliny, in his Natural History. This stone fell near Egospotamos, in Thrace, about 465 years before the Christian era. Pliny informs us that it was still shown in his day, and that it was the size of a cart, and of a burnt colour. The Greeks believed it to have fallen from the sun, and that the philosopher Anaxagoras had predicted the exact period when it should arrive on the earth's surface. According to the historians who have recorded the event, its fall was preceded by a meteoric appearance of a very unusual character. We are told that a large fiery body, like a cloud of flame, careered through the heavens with a vague uncertain motion. By its violent agitation, several fragments were projected from it in various directions, sweeping with the velocity of "shot stars down the troubled sky." On examining it after its fall, no trace of combustible matter was found, and the stone, although large, did not at all correspond to the dimensions of the meteor. Various other instances are recorded of the fall of meteoric stones in ancient times, but we prefer giving an account of the better authenticated cases which belong to a modern date.

On the 7th of November 1492, between eleven o'clock and noon, there arose a furious storm at Ensisheim, a town of France. The sky was inlaid with sheeted flame, and loud thunder "pealed in the blood-red heaven." We are told by a contemporary that there were also other sounds of a strange confused description; these probably arose from the rapid passage of the falling body through the atmosphere. In the midst of this "hurtling in the air," a large stone was seen to fall in a field of wheat; and, on examination, it was found to of these," says this great botanist, "that we saw, was about a musket-shot from our ship. There we perceived the water begin to boil, and to rise about a foot above its level. The water was agitated and whitish; and above its surface there seemed to stand a smoke, such as might be imagined to come from wet straw before it begins to blaze. It made a sort of

---

have sunk between five and six feet into the ground; its weight was about 260 lbs. In the true spirit of the times, this event was considered an indubitable miracle, and the meteorolite was accordingly, by order of the king, suspended in the church of Ensisheim, all persons being prohibited from touching it. At all events, this was a wise prohibition, and was probably the cause of its preservation. It is now in the library at Colmar, but has been reduced in weight to 150 lbs.

The celebrated Gassendi informs us, that, on the 29th November 1637, about 10 o'clock A. M., while the sky was perfectly serene and transparent, he saw a flaming stone, apparently about four feet diameter, fall on Mount Vaision, an eminence situated between the small towns of Perne and Guillaumes, in Provence. This stone was encircled with a zone of various colours, like a rainbow, and accompanied in its fall with a noise resembling the discharge of artillery. It was of a dark metallic colour, extremely hard, and 59 lbs. in weight.

In June 1668, two stones, one of which weighed 300, and the other 200 lbs., fell near Verona. The event took place during the night, and when the weather was perfectly serene and mild. They appeared to be all on fire, descending in a sloping direction, and with a tremendous noise. The phenomenon was witnessed by a great number of people, who, when the sounds had ceased, and their courage sufficiently re-established, ventured to approach these celestial deposits, and found that they had formed a ditch, with such a velocity and force had they descended from the heavens.

In July 1790, another case occurred at Barbotan, a place in the vicinity of Bourdeaux, which is thus described by Lomet, a respectable citizen who witnessed the phenomenon:—"It was a very bright fire-ball, luminous as the sun, of the size of an ordinary balloon, and, after inspiring the inhabitants with consternation, burst, and disappeared. A few days after, some peasants brought stones, which they said fell from the meteor; but the philosophers to whom they offered them laughed at their assertions as fabulous. The peasants would have now more reasons to laugh at the philosophers." So they would, Monsieur Lomet. One of these stones, fifteen inches in diameter, broke through the roof of a cottage, and killed a herdsman and a bullock. After reading the above statement, we cannot refrain from wondering at the slow belief of philosophers as to the heavenly origin of these stones. Where was the body to come from, a body of the dimensions described, which was capable of breaking through the roof of a cottage, and committing such deadly havoc, if it did not come from the atmosphere, ay, and from an immense height too?

The following shower of meteorolites is not only remarkable in itself, but because, though slighted by many eminent philosophers at the time, it ultimately led to the conversion of most of them. This phenomenon occurred in August 1790, near Juillac, a small town of France. It is described, amongst others, by two credible witnesses nearly as follows:—About nine o'clock in the evening, while the air was calm and the sky cloudless, they found themselves suddenly surrounded by a pale, clear light, which obscured that of the moon, though then nearly full. On looking up, they observed, almost in the zenith, a fire-ball, in size exceeding the diameter of the moon, with a tail five or six times longer than itself, which gradually tapered to a point, the latter approaching to blood-red, though the rest of the meteor was of a pale white. It proceeded with amazing velocity from south to north, and in two seconds split into portions of considerable size, like the fragments of a bursting bomb. Two or three minutes after, a dreadful explosion was heard, like the simultaneous firing of several pieces of ordnance. The concussion of the atmosphere shook the windows in their frames, and threw down household utensils from their shelves: but there was no sensible motion felt under foot. The sound continued for some time, and was prolonged in echoes for fifty miles along the mountain chain of the Pyrenees. At the same time a strong sulphurous smell was diffused in the atmosphere. The fragments of the exploded meteor were found scattered in a circular space of about two miles in diameter. Some of them weighed eighteen or twenty, and a few, it is said, even fifty pounds.

We pass over several interesting details of these phenomena, and proceed to notice the great shower of stones which fell at Aigle, in Normandy, in April 1803. The best account is that given by Biot, the celebrated French philosopher, who was appointed by the Institute of France to proceed to Aigle, and collect all the information possible upon the subject. He says—"On Tuesday, 6th Floréal, year 11 (April 26, 1803,) about one o'clock P. M., the weather being serene, there was observed from Caen, Pont d'Audemer, and the environs of Alençon, Falaise, and Verneuil, a fiery globe, of a very brilliant splendour, and which moved in the atmosphere with great rapidity. Some moments after, there was heard at l'Aigle, and in the environs of that town, in the extent of more than 30 leagues in every direction, a violent explosion, which lasted five or six minutes. At first there were three or four reports, like those of a cannon, followed by a kind of discharge which resembled the firing of musketry; after which there was heard a dreadful rumbling, like the beating of a drum. The air was calm, and the sky serene, except a few clouds, such as are frequently observed. This noise proceeded from a small cloud which had a rectangular form, the largest side being in a direction from east to west. It appeared motionless all the time that the phenomenon lasted; but the vapours of which it was composed were projected momentarily from different sides, by the effect of the successive explosions. This cloud was about half a league to the north-north-west of the town of l'Aigle. It was at a great elevation in the atmosphere, for the inhabitants of two hamlets, a league distant from each other, saw it at the same time above their heads. In the whole canton over which this cloud was suspended, there was heard a hissing noise, like that of a stone discharged from a sling, and a great many mineral masses exactly similar to those distinguished by the name of *meteor-stones* were seen to fall. The district in which these masses were projected forms an elliptical extent of about two leagues and a half in length, and nearly one in breadth, the greatest dimension being in a direction from south-east to north-west, forming a declination of about 22 degrees. This direction, which the meteor must have followed, is exactly that of the magnetic meridian, which is a remarkable result. The greatest of these stones fell at the south-eastern extremity of the large axis of the ellipse, the middle-sized in the centre, and the smaller at the other extremity. Hence it appears that the largest fell first, as might naturally be supposed. The largest of all those that fell weighs seventeen pounds and a half. The smallest which I have seen weighs about two *gros* (a thousandth part of the last.) The number of all those which fell is certainly above two or three thousand."

In the same month and year as the preceding fall, a fire-ball struck the White Bull Inn, at East Norton, in murmuring sound, like that of a torrent heard at a distance, mixed, at the same time, with a hissing noise like that of a serpent; shortly after we perceived a column of this smoke rise up to the clouds, at the same time whirling about with great rapidity. It appeared to be as thick as one's finger; and the former sound still continued. When this disappeared, after lasting for about eight minutes, upon turning to the opposite quarter of the sky, we perceived another, which began in the manner of the former; presently after, a third appeared in the west; and instantly beside it still another arose. The most distant of these three could not be above a musket-shot from the ship. They all continued like so many heaps of wet straw set on fire, that continued to smoke, and to make the same noise as before. We soon after perceived each, with its respective canal, mounting up in the clouds, and spreading where it touched; the cloud, like the mouth of a trumpet, making a figure (to express it intelligibly) as if the tail of an animal were pulled at one end by a weight. These canals were of a whitish colour, and so tinged, as I suppose, by the water which was contained in them; for previous to this they were apparently empty, and of the colour of transparent glass. These canals were not straight, but bent in some parts, and far from being perpendicular, but rising in their clouds with a very inclined ascent. But what is very particular, the cloud to which one of them was pointed happening to be driven by the wind, the spout still continued to follow its motion without being broken; and passing behind one of the others, the spouts crossed each other, in the form of a St Andrew's cross. In the beginning they were all about as thick as one's finger, except at the top, where they were broader, and two of them disappeared; but shortly after, the last of the three increased considerably; and its canal, which was at first so small, soon became as thick as a man's arm, then as his leg, and at last thicker than his whole body. We saw distinctly, through this transparent body, the water which rose up with a kind of spiral motion; and it sometimes diminished a little of its thickness, and again resumed the same, sometimes widening at top, and sometimes at bottom; exactly resembling a gut filled with water, pressed with the fingers to make the fluid rise or fall; and I am well convinced that this alteration in the spout was caused by the wind, which pressed the cloud, and impelled it to give up its contents. After some time its bulk was so diminished as to be no thicker than a man's arm again; and thus swelling and diminishing, it at last became very small. In the end, I observed the sea which was raised above it to resume its level by degrees, and the end of the canal that touched it to become as small as if it had been tied round with a cord; and this continued till the light striking through the cloud took away the view. I still however continued to look, expecting that its parts would join again, as I had before seen in one of the others, in which the spout was more than once broken, and yet again came together; but I was disappointed, for the spout appeared no more."*

Many have been the solutions offered for this surprising appearance. Mr Buffon supposes the spout here described, to proceed from the operation of fire, beneath the bed of the sea; as the waters at the surface are thus seen agitated. However, the solution of Dr Stuart is not divested of probability; who thinks it may be accounted for by suction, as in the application of a cupping-glass to the skin.

Wherever spouts of this kind are seen, they are extremely dreaded by mariners; for if

---

England, and left behind it several meteoric fragments. Exactly twelve months after the above, a stone fell with a loud hissing noise at Possil, near Glasgow. In 1810, a great stone fell at Shahabad, in India. It burned five villages, and killed several people.

Such are a few instances of the descent of meteoric stones. In a late number of a French periodical, above two hundred falls are enumerated. That they occur frequently is evident. How many relations of the phenomena may have passed into oblivion from the contempt with which they were treated by the learned! How many showers may have fallen in desert and unexplored tracts of country, on the tops of inaccessible mountains, and in the pathless expanse of the sea!

With respect to the ultimate origin of these stones, no perfectly satisfactory theory has yet been propounded. Some have supposed them to be merely projected from volcanoes. This doctrine, however, appears untenable; first, because the phenomena have sometimes taken place at such immense distances from any volcano, that the possibility of their being transmitted so far can scarcely be entertained; secondly, nothing ever thrown out by these safety-valves of the globe, has, in its composition, borne any resemblance to meteoric stones. Indeed, the latter have nothing similar to them on the surface of the earth, as far as man has yet been able to investigate. This is a very extraordinary circumstance, and, when taken in connection with the fact already noticed, that the whole of them consist of the same substances, or nearly so, it seems to favour the hypothesis that they were thrown from our satellite, the moon. The profound La Place demonstrated the *possibility* of this, and Dr Hutton, with great ingenuity, has reasoned upon the *probability* of it. Others have followed in the same wake, but the subject is still involved in great obscurity. Some have maintained that their origin is to be ascribed to the combinations of gases in the higher regions of the atmosphere. In chemistry, many cases might be enumerated where two gases combine, and form a solid substance. This theory, therefore, involves no impossibility; but there are almost insuperable difficulties opposed to its probability. It would hence be an unfruitful task to speculate upon a subject which so few scientific men have formed any definite opinions upon; indeed, they have been singularly cautious in offering any—a clear proof that they were not themselves perfectly satisfied with any solution of the problem hitherto given. The fact, however, that stones have fallen from the atmosphere, is now an established philosophical truth.

they happen to fall upon a ship, they most commonly dash it to the bottom. But if the ship be large enough to sustain the deluge, they are at least sure to destroy its sails and rigging, and render it unfit for sailing. It is said that vessels of any force usually fire their guns at them, loaden with a bar of iron; and if so happy as to strike them, the water is instantly seen to fall from them with a dreadful noise, though without any further mischief.

I am at a loss whether we ought to reckon these spouts called *typhons*, which are sometimes seen at land, of the same kind with those so often described by mariners at sea, as they seem to differ in several respects. That, for instance, observed at Hatfield in Yorkshire, in 1687, as it is described by the person who saw it, seems rather to have been a whirlwind than a water-spout. The season in which it appeared was very dry, the weather extremely hot, and the air very cloudy. After the wind had blown for some time with considerable force, and condensed the black clouds one upon another, a great whirling of the air ensued; upon which the centre of the clouds every now and then darted down, in the shape of a thick long black pipe; in which the relater could distinctly view a motion like that of a screw, continually screwing up to itself, as it were, whatever it happened to touch. In its progress it moved slowly over a grove of young trees, which it violently bent in a circular motion. Going forward to a barn, it, in a minute, stript it of all the thatch, and filled the whole air with the same. As it came near the relater, he perceived that its blackness proceeded from a gyration of the clouds, by contrary winds meeting in a point, or a centre; and where the greatest force was exerted, there darting down like an Archimedes' screw, to suck up all that came in its way. Another which he saw some time after was attended with still more terrible effects; levelling or tearing up great oak trees, catching up the birds in its vortex, and dashing them against the ground. In this manner it proceeded, with an audible whirling noise, like that of a mill; and at length dissolved, after having done much mischief.

But we must still continue to suspend our assent as to the nature even of these land spouts, since they have been sometimes found to drop, in a great column of water, at once upon the earth, and produce an instant inundation,[1] which could not readily have happened had they been caused by the gyration of a whirlwind only. Indeed, every conjecture regarding these meteors seems to me entirely unsatisfactory. They sometimes appear in the calmest weather at sea, of which I have been an eye-witness; and therefore these are not caused by a whirlwind. They are always capped by a cloud; and therefore are not likely to proceed from fires at the bottom. They change place; and therefore suction seems impracticable. In short, we still want facts, upon which to build a rational theory; and instead of knowledge, we must be contented with admiration. To be well acquainted with the appearances of nature, even though we are ignorant of their causes, often constitute the most useful wisdom.

CHAP. XXII.

THE CONCLUSION.

Having thus gone through a particular description of the earth, let us now pause for a moment, to contemplate the great picture before us. The universe may be considered as the palace in which the Deity resides; and this earth as one of its apartments. In this, all the meaner races of animated nature mechanically obey him; and stand ready to execute his commands without hesitation. Man alone is found refractory; he is the only being endued with a power of contradicting these mandates. The Deity was pleased to exert superior power in creating him a superior being: a being endued with the choice of good and evil; and capable in some measure, of co-operating with his own intentions. Man, therefore, may be considered as a limited creature, endued with powers imitative of those residing in the Deity. He is thrown into a world that stands in need of his help; and has been granted a power of producing harmony from partial confusion.

If, therefore, we consider the earth as allotted for our habitation, we shall find that much has been given us to enjoy, and much to amend; that we have ample reasons for our gratitude, and still more for our industry. In those great outlines of nature, to which art cannot reach, and where our greatest efforts must have been ineffectual, God himself has finished these with amazing grandeur and beauty. Our beneficent Father has considered those parts of nature as peculiarly his own; as parts which no creature could have skill or strength to amend: and therefore made them incapable of alteration, or of more perfect regularity. The heavens and the firmament show the wisdom and the glory of the workman. Astronomers, who are best skilled in the symmetry of systems, can find nothing there that they can alter for the better.

---

[1] Phil. Trans. vol. iv. p. ii. 108.

God made these perfect, because no subordinate being could correct their defects.

When, therefore, we survey nature on this side, nothing can be more splendid, more correct, or amazing. We there behold a Deity residing in the midst of a universe, infinitely extended every way, animating all, and cheering the vacuity with his presence! We behold an immense and shapeless mass of matter, formed into worlds by his power, and dispersed at intervals, to which even the imagination cannot travel! In this great theatre of his glory, a thousand suns, like our own, animate their respective systems, appearing and vanishing at Divine command. We behold our own bright luminary fixed in the centre of its system, wheeling its planets in times proportioned to their distances, and at once dispensing light, heat, and action. The earth also is seen with its two-fold motion; producing, by the one, the change of seasons; and by the other, the grateful vicissitudes of day and night. With what silent magnificence is all this performed! with what seeming ease! The works of art are exerted with interrupted force; and their noisy progress discovers the obstructions they receive: but the earth, with a silent steady rotation, successively presents every part of its bosom to the sun; at once imbibing nourishment and light from that parent of vegetation and fertility.

But not only provisions of heat and light are thus supplied, but its whole surface is covered with a transparent atmosphere, that turns with its motion, and guards it from external injury. The rays of the sun are thus broken into a genial warmth; and, while the surface is assisted, a gentle heat is produced in the bowels of the earth, which contributes to cover it with verdure. Waters also are supplied in healthful abundance, to support life and assist vegetation. Mountains arise, to diversify the prospect, and give a current to the stream. Seas extend from one continent to the other, replenished with animals that may be turned to human support; and also serving to enrich the earth with a sufficiency of vapour. Breezes fly along the surface of the fields, to promote health and vegetation. The coolness of the evening invites to rest; and the freshness of the morning renews for labour.

Such are the delights of the habitation that has been assigned to man! Without any one of these, he must have been wretched; and none of these could his own industry have supplied. But while many of his wants are thus kindly furnished on the one hand, there are numberless inconveniences to excite his industry on the other. This habitation, though provided with all the conveniences of air, pasturage, and water, is but a desert place, without human cultivation. The lowest animal finds more conveniences in the wilds of nature than he who boasts himself their lord. The whirlwind, the inundation, and all the asperities of the air, are peculiarly terrible to man, who knows their consequences, and at a distance, dreads their approach. The earth itself, where human art has not pervaded, puts on a frightful gloomy appearance. The forests are dark and tangled; the meadows overgrown with rank weeds; and the brooks stray without a determined channel. Nature that has been kind to every lower order of beings, has been quite neglectful with regard to him; to the savage uncontriving man the earth is an abode of desolation, where his shelter is insufficient, and his food precarious.

A world thus furnished with advantages on one side, and inconveniences on the other, is the proper abode of reason, is the fittest to exercise the industry of a free and a thinking creature. Those evils which art can remedy, and prescience guard against, are a proper call for the exertion of his faculties; and they tend still more to assimilate him to his Creator. God beholds with pleasure that being which he has made, converting the wretchedness of his natural situation into a theatre of triumph; bringing all the headlong tribes of nature into subjection to his will; and producing that order and uniformity upon earth, of which his own heavenly fabric is so bright an example.

A

HISTORY OF ANIMALS.

CHAP. I.

A COMPARISON OF ANIMALS WITH THE INFERIOR RANKS OF CREATION.

HAVING given an account of the earth, in general, and the advantages and inconveniences with which it abounds, we now come to consider it more minutely. Having described the habitation, we are naturally led to inquire after the inhabitants. Amidst the infinitely different productions which the earth offers, and with which it is every where covered, animals hold the first rank; as well because of the finer formation of their parts, as of their superior power. The vegetable which is fixed to one spot, and obliged to wait for its accidental supplies of nourishment, may be considered as the prisoner of nature. Unable to correct the disadvantages of its situation, or to shield itself from the dangers that surround it, every object that has motion may be its destroyer.

But animals are endowed with powers of motion and defence. The greatest part are capable, by changing place, of commanding nature; and of thus obliging her to furnish that nourishment which is most agreeable to their state. Those few that are fixed to one spot, even in this seemingly helpless situation, are, nevertheless, protected from external injury by a hard shelly covering; which they often can close at pleasure, and thus defend themselves from every assault. And here, I think, we may draw the line between the animal and vegetable kingdoms. Every animal, by some means or other, finds protection from injury; either from its force or courage, its swiftness or cunning. Some are protected by hiding in convenient places; and others by taking refuge in a hard resisting shell. But vegetables are totally unprotected; they are exposed to every assailant, and patiently submissive in every attack. In a word, an animal is an organized being, that is, in some measure, provided for its own security; a vegetable is destitute of every protection.

But though it is very easy, without the help of definitions, to distinguish a plant from an animal, yet both possess many properties so much alike, that the two kingdoms, as they are called, seem mixed with each other. Hence, it frequently puzzles the naturalists to tell exactly where animal life begins, and vegetative terminates; nor indeed is it easy to resolve, whether some objects offered to view be of the lowest of the animal, or the highest of the vegetable races. The sensitive plant, that moves at the touch, seems to have as much perception as the fresh-water polypus, that is possessed of a still slower share of motion. Besides, the sensitive plant will not reproduce upon cutting in pieces, which the polypus is known to do; so that the vegetable production seems to have the superiority. But, notwithstanding this, the polypus hunts for its food, as most other animals do. It changes its situation; and therefore possesses a power of choosing its food, or retreating from danger. Still, therefore, the animal kingdom is far removed above the vegetable; and its lowest denizen is possessed of very great privileges, when compared with the plants with which it is often surrounded.

However, both classes have many resemblances, by which they are raised above the unorganized and inert masses of nature. Minerals are mere inactive, insensible bodies, entirely motionless of themselves, and waiting some external force to alter their forms or their properties. But it is otherwise with animals and vegetables; these are endued with life and vigour; they have their state of improvement and decay; they are capable of re-producing their kinds; they grow from seeds in some, and from cuttings in others; they seem all possessed of sensation, in a greater or less degree; they both have their enmities and affections; and as some animals are, by nature, impelled to violence, so some plants are found to exterminate all others, and make a wilderness of the places round them. As the lion makes a desert of the forest where it resides, thus no other plant will grow under the shade of the manchineel-tree. Thus, also, that plant, in the West-Indies, called *caraguata*, clings round whatever tree it happens to approach: there it quickly gains the ascendant; and loading the tree with a verdure not its own, keeps away that nourishment designed to feed the trunk; and at last, entirely destroys its supporter. As all animals are ultimately supported upon vegetables, so vegetables are greatly propagated by being made a part of animal food. Birds distribute the seeds wherever they fly, and quadrupeds prune them into great luxuriance. By these means the quantity of food, in a state of nature, is kept equal to the number of the consumers; and, lest some of the weaker ranks of animals should find nothing for their support, but all the provisions be devoured by the strong, different vegetables are appropriated to different appetites. If, transgressing this rule, the stronger rank should invade the rights of the weak, and breaking through all regard to appetite, should make an indiscriminate use of every vegetable, nature then punishes the transgression, and poison marks the crime as capital.

If, again, we compare vegetables and animals, with respect to the places where they are found, we shall find them bearing a still stronger similitude.[1] The vegetables that grow in a dry and sunny soil, are strong and vigorous, though not luxuriant; so also are the animals of such a climate. Those, on the contrary, that are the joint product of heat and moisture, are luxuriant and tender; and the animals assimilating to the vegetable food, on which they ultimately subsist, are much larger in such places than in others. Thus, in the internal parts of South America and Africa, where the sun usually scorches all above, while inundations cover all below, the insects, reptiles, and other animals, grow to a prodigious size: the earth-worm of America is often a yard in length, and as thick as a walking cane; the boiguacu, which is the largest of the serpent kind, is sometimes forty feet in length; the bats in those countries are as big as a rabbit; the toads are bigger than a duck; and their spiders are as large as a sparrow. On the contrary, in the cold frozen regions of the north, where vegetable nature is stinted of its growth, the few animals in those climates partake of the diminution; all the wild animals, except the bear, are much smaller than in milder countries; and such of the domestic kinds as are carried thither, quickly degenerate, and grow less. Their very insects are of the minute kinds, their bees and spiders being not half so large as those in the temperate zone.

---

[1] On a superficial view, vegetables seem more abundant than animals; so contrary, however, is this to fact, that the species of animals, when compared with those of plants, may be considered in the proportion of 10 to 1. Hence it follows that botany, when compared with zoology, is a very limited study: plants, when considered in relation to insects alone, bear no proportion in the number of the species. The phanerogamous plants of Britain have been estimated in round numbers at 1500, while the insects that have already been discovered in this country (and probably many hundreds still remain unknown) amount to 10,000, which is more than six insects to one plant. It is therefore obvious that the knowledge acquired on the geographical distribution of animals, in comparison with what is known of plants, is slight and unsatisfactory: it is likewise attended with difficulties inseparable from the nature of beings so numerous and diversified, and which will always render it comparatively imperfect. It rarely happens that a single specimen of a plant is found isolated; the botanist can therefore immediately arrive at certain conclusions: if he is in a mountainous country, he is enabled to trace, without much difficulty, the lowest and the highest elevation at which a particular species is found; and the nature of the soil, which may be considered the food of the plant, is at once known. But these advantages do not attend the zoologist: his business is with beings perpetually moving upon the earth, or hid in the depths of ocean, performing numerous functions in secret; while of the marine tribes he can never hope to be acquainted with more than a very insignificant portion. The following observations must therefore be considered as merely an outline of those general laws which seem to regulate the geography of animals.

The distribution of animals on the face of the globe must be considered under two heads, general and particular. The first relates to families or groups inhabiting particular zones, and to others by which they are represented in another hemisphere. The second refers to the local distribution of the animals of any particular country, or to that of individual species. It is to the general distribution of groups, as a celebrated writer has well observed, that the philosophic zoologist should first direct his attention, rather than to the locality of species. By studying nature in her higher groups, we discover that certain functions are developed under different forms, and we begin to discern something of the great plan of providence in the creation of animals, and arrive at general results, which must be for ever hid from those who limit their views to the habitations of species, or to the local distribution of animals.

Animals, like plants, are generally found to be distributed in zones. Fabricius, in speaking of insects, divides the globe into eight climates, which he denominates the Indian, Egyptian, southern, Mediterranean, northern, oriental, occidental, and alpine. In the first he includes the tropics; in the second, the northern region immediately adjacent; in the third, the southern; in the fourth, the countries bordering on the Mediterranean Sea, including also Armenia and Media; in the fifth, the northern part of Europe, interjacent between Lapland and Paris; in the sixth, the northern part of Asia, where the cold in winter is intense; in the seventh, North America, Japan, and China; and in the eighth, all those mountains whose summits are covered with eternal snow. It is, however, easy to perceive, that this, though a very ingenious, is a very artificial theory; the divisions are vague and arbitrary, and we know that animals of one country differ essentially from those of another, although both may enjoy the same degree of temperature. M. Latreille has therefore attempted a more definite theory. His two primary divisions are the arctic and antarctic climates, according to their situation above or below the equinoctial line; and taking twelve degrees of latitude for each climate, he subdivides the whole into twelve. Beginning at 84° N. L., he has seven arctic climates: viz. the polar, subpolar, superior, intermediate, supratropical, tropical, and equatorial: but his antarctic climates, as no land has been discovered below 60° S. L., amount only to five, beginning with the equatorial, and terminating with the superior. He proposes also a further division of subclimates, by means of certain meridian lines; separating thus the old world from the new, and subdividing the former into two great portions; an eastern, beginning with India; and a western, terminating with Persia. He proposes, further, that each climate should be considered as having 24° of longitude and 12° of latitude. This system certainly approximates more to what we see in nature than that proposed by Fabricius; yet Mr Kirby observes with truth, that the division of the globe into climates by equivalent parallels and meridians wears the appearance of an artificial and arbitrary system, rather than of one according to nature.

The similitude between vegetables and animals is no where more obvious than in those that belong to the ocean, where the nature of one is admirably adapted to the necessities of the other. This element, it is well known, has its vegetables, and its insects that feed upon them, in great abundance. Over many tracts of the sea, a weed is seen floating, which covers the surface, and gives the resemblance of a green and extensive meadow. On the under side of these unstable plants, millions of little animals are found adapted to their situation. For as their ground, if I may so express it, lies over their heads, their feet are placed upon their backs; and as land animals have their legs below their bodies, these have them above. At land also, most animals are furnished with eyes to see their food; but at sea, almost all the reptile kinds are without eyes, which might only give them prospects of danger at a time when unprovided with the means of escaping it.[1]

Thus, in all places, we perceive an obvious similitude between the animals and the vegetables of every region. In general, however, the most perfect races have the least similitude to the vegetable productions on which they are ultimately fed; while, on the contrary, the meaner the animal, the more local it is found to be, and the more it is influenced by the varieties of the soil where it resides. Many of the more humble reptile kinds are not only confined to one country, but also to a plant; nay, even to a leaf. Upon that they subsist; increase with its vegetation, and seem to decay as it declines. They are merely the circumscribed inhabitants of a single vegetable: take them from that, and they instantly die; being entirely assimilated to the plant they feed on, assuming its colour, and even its medicinal properties. For this reason there are infinite numbers of the meaner animals that we have never an opportunity of seeing in this part of the world; they are incapable of living separate from their kindred vegetables, which grow only in a certain climate.

Such animals as are formed more perfect, lead a life of less dependence; and some kinds are found to subsist in many parts of the world at the same time. But, of all the races of animated nature, man is the least affected by the soil where he resides, and least influenced by the variations of vegetable sustenance: equally unaffected by the luxuriance of the warm climates, or the sterility of the poles, he has spread his habitations over the whole earth; and finds subsistence as well amidst the ice of the north as the burning deserts under the line. All creatures of an inferior nature, as has been said, have peculiar propensities to peculiar climates; they are circumscribed to zones, and confined to territories, where their proper food is found in the greatest abundance; but man may be called the animal of every climate, and suffers but very gradual alterations from the nature of any situation.

As to animals of a meaner rank, whom man compels to attend him in his migrations, these being obliged to live in a kind of constraint, and upon vegetable food often different from that of their native soil, they very soon alter their natures with the nature of their nourishment, assimilate to the vegetables upon which they are fed, and thus assume very different habits as well as appearances. Thus man, unaffected himself, alters and directs the nature of other animals at his pleasure; increases their strength for his delight, or their patience for his necessities.

This power of altering the appearances of things, seems to have been given him for very wise purposes. The Deity, when he made the earth, was willing to give his favoured

---

Vertebrated animals have a wider range than invertebrated animals, thus resembling man, who is spread over the whole earth: the dog and the crow are found wild in almost every climate; the swallow traverses, in a few days, from the temperate to the torrid zone; and numerous other birds annually perform long migrations. Next to these, insects, above all the other invertebratæ, enjoy the widest range.

Marine animals have, in general, a wider range than those strictly terrestrial. This may probably originate in their being more independent of the effects of temperature.—*Loudon's Encyclopedia of Agriculture.*

[1] Linnæi Amænitates, vol. v. p. 68.

creature many opponents, that might at once exercise his virtues, and call forth his latent abilities. Hence we find, in those wide uncultivated wildernesses, where man, in his savage state, owns inferior strength, and the beasts claim divided dominion, that the whole forest swarms with noxious animals and vegetables; animals as yet undescribed, and vegetables which want a name. In those recesses, nature seems rather lavish than magnificent in bestowing life. The trees are usually of the largest kinds, covered round with parasite plants, and interwoven at the tops with each other. The boughs, both above and below, are peopled with various generations; some of which have never been upon the ground, and others have never stirred from the branches on which they were produced. In this manner, millions of minute and lothesome creatures pursue a round of uninterrupted existence, and enjoy a life scarcely superior to vegetation. At the same time, the vegetables in those places are of the larger kinds, while the animal race is of the smaller: but man has altered this disposition of nature; having, in a great measure, levelled the extensive forests, cultivated the softer and finer vegetables, destroyed the numberless tribes of minute and noxious animals, and taken every method to increase a numerous breed of the larger kinds. He thus has exercised a severe control; unpeopled nature, to embellish it, and diminished the size of the vegetable, in order to improve that of the animal kingdom.

To subdue the earth to his own use, was, and ought to be, the aim of man; which was only to be done by increasing the number of plants, and diminishing that of animals: to multiply existence *alone*, was that of the Deity. For this reason, we find, in a state of nature, that animal life is increased to the greatest quantity possible; and, we can scarcely form a system that could add to its numbers. First, plants, or trees, are provided by nature of the largest kinds; and, consequently, the nourishing surface is thus extended. In the second place, there are animals peculiar to every part of the vegetable, so that no part of it is lost. But the greatest possible increase of life would still be deficient, were there not other animals that lived upon animals; and these are, themselves, in turn, food for some other greater and stronger set of creatures. Were all animals to live upon vegetables alone, thousands would be extinct that now have existence, as the quantity of their provision would shortly fail. But, as things are wisely constituted, one animal now supports another; and thus, all take up less room than they would by living on the same food; as, to make use of a similar instance, a greater number of people may be crowded into the same space, if each is made to bear his fellow upon his shoulders.

To diminish the number of animals and increase that of vegetables, has been the general scope of human industry; and if we compare the utility of the kinds. with respect to man, we shall find, that of the vast variety in the animal kingdom, but very few are serviceable to him; and, in the vegetable, but very few are entirely noxious. How small a part of the insect tribes, for instance, are beneficial to mankind, and what numbers are injurious. In some countries they almost darken the air: a candle cannot be lighted without their instantly flying upon it, and putting out the flame.[1] The closest recesses are no safeguard from their annoyance; and the most beautiful landscapes of nature only serve to invite their rapacity. As these are injurious, from their multitudes, so most of the larger kinds are equally dreadful to him from their courage and ferocity. In the most uncultivated parts of the forest these maintain an undisputed empire; and man invades their retreats with terror. These are dreadful; and there are still more which are utterly useless to him, that serve to take up the room which more beneficial creatures might possess; and incommode him rather with their numbers than their enmities. Thus, in a catalogue of land-animals, that amounts to more than twenty thousand, we can scarcely reckon up a hundred that are any way useful to him; the rest being either wholly his open or his secret enemies, immediately attacking him in person, or intruding upon that food he has appropriated to himself. Vegetables, on the contrary, though existing in greater variety, are but few of them noxious. The most deadly poisons are often of great use in medicine; and even those plants that only seem to cumber the ground, serve for food to the race of animals which he has taken into friendship or protection. The smaller tribes of vegetables, in particular, are cultivated, as contributing either to his necessities or amusement; so that vegetable life is as much promoted by human industry, as animal life is controlled and diminished

Hence it was not without a long struggle, and various combinations of experience and art, that man acquired his present dominion. Almost every good that he possesses was the result of the contest; for, every day, as he was contending, he was growing more wise: and patience and fortitude were the fruits of his industry.

Hence, also, we see the necessity of some animals living upon each other, to fill up the plan of Providence; and we may, consequently, infer the expediency of man's living upon all. Both animals and vegetables seem equally fitted to his appetites; and, were any religious or moral motives to restrain him from taking away life, upon any account, he would only thus give existence to a variety of beings made to prey upon each other: and, instead of preventing, multiply mutual destruction.

---

[1] Ulloa's Description of Guayaquil.

CHAP. II.

OF THE GENERATION OF ANIMALS.[1]

BEFORE we survey animals in their state of maturity, and performing the functions adapted to their respective natures, method requires that we should consider them in the more early periods of their existence. There has been a time when the proudest and the noblest animal was a partaker of the same imbecility with the meanest reptile; and, while yet a candidate for existence, equally helpless and contemptible. In their incipient state, all are upon a footing; the insect and the philosopher being equally insensible, clogged with matter, and unconscious of existence. Where then are we to begin with the history of those beings, that make such a distinguished figure in the creation? Or, where lie those peculiar characters in the parts that go to make up animated nature—that mark one animal as destined to creep in the dust, and another to glitter on the throne?

This has been a subject that has employed

---

[1] The generative power, that wonderful attribute of organized beings, is differently developed in vegetables and animals. In all the families of the agamous plants, or those in which the sex is unknown, as the truffles, algæ, &c., as well as in the radiary animals, polypi, hydres, meduses, actinies, holothuries, &c., reproduction is effected by a simple division of the individual, which forms complete individuals, or by shoots, or by expansions of the procreative being when it has a superabundance of nutrition and life. Many of the most perfect plants, in which the sex is very apparent, as all the phanerogamous, are capable of multiplying themselves by grain and seeds, by shoots, sprouts, suckers, portions of the root, twigs, &c. This is not so with animals of sex, which must couple to engender, as all the dioïc species, or by themselves, as the monoïc, such as the bivalvular molluscæ.

Among the species provided with sex in the animal and vegetable kingdom, there is a great difference relative to fecundity.

Female plants seem more capable of multiplying, even without the intervention of the male. Thus, we observe females of dioïc vegetables which are cultivated in Europe alone, as the broussonotia papyrifera, the populus balsamifera propagate by twigs, whilst all the male individuals of this class are more feeble, and do not multiply by the same means. Even some female plants produce male flowers; as Forster has observed in the islands of the South seas. Spallanzani has seen the female of the hemp produce fecund grains. Again, the stamens are sometimes changed in flowers, while the female organs remain immutable.

In the animal kingdom, on the contrary, male individuals are more robust, and more capable of fecundating than females; and as to the proportion of the species, one bull or one cock is sufficient for a number of females, which is the inverse of plants, in which the stamens almost always surpass the number of the pistils.

The relative multiplication of plants and animals appears to be equally prodigious; and it is doubtful even if the animal kingdom has the superiority. A sprig of maize produces 2,000 grains; a sun-flower has double the number; a stalk of poppy affords 32,000 seeds, one of tobacco more than 40,000; an elm-tree furnishes 100,000 grains annually, a clove more than 720,000, besides those which produce double the number. The smallest herring has nearly 10,000 eggs. Bloch found 100,000 in a carp that weighed only half a pound. P. Petit discovered in another, about four inches long, 262,820 eggs; and in another, weighing six ounces, 342,144. A perch had 380,000, and a female sturgeon was computed to have 7,653,200 eggs. Leuwenhoek calculated, in this manner, 344,000 eggs in a cod fish. This fish alone would, in a few years, produce millions of its kind; and if these reproduced in proportion, millions of millions would be engendered in turn, which shows the immense, nay, the incalculable fecundity of nature.

The boundaries of the universe would become too confined, if we supposed this reproductive power active in all its sources, without any thing to arrest it; because nature is impetuous in reproduction, on account of the inconceivable attraction of pleasure, so that the equilibrium of the universe could not subsist without the power of destruction, which re-establishes the level or medium of all beings.

But happily the power of reproduction is more limited in the human species, though sexual union is more frequent than between other animals; and we see in this that which is in favour of nature.

Each of the two ovaries of the human female contains from fifteen to twenty ova or eggs; and very few women have had this number of infants. It may, however, be remarked, that fecundity is greater with man than with woman. Pregnancy, the puerperal or child-bed state, and lactation, are opposed to reproduction, but a husband might, if the laws of morals, religion, and society, permitted, engender with numerous healthful women during these states. It is also to be borne in mind that the male is more robust and free from diseases than the female, and that he enjoys the generative faculty much longer. Women seldom have offspring in temperate climates, after the age of forty-five or fifty, when the menstrual function ceases; while men continue to propagate until the age of sixty-five or eighty, and even later, of which there are numerous and daily examples. A very remarkable instance was lately recorded in the public press, (1832 or 33), of a Scottish gentleman, who had fifty-seven illegitimate children by different women; he died intestate, and possessed of a large property, none of which came to his numerous offspring.

M. Virey gives the following account of fecundation and fecundity. It is generally observed, that women begin to lose their fecundity from the age of forty-two to forty-nine. This faculty diminishes in men from the age of fifty to sixty years, but it may exist for some years later. These periods are not rigorously exact, though generally so; but climates, passions, and modes of life, cause many modifications. The eastern people, for example, arrive at puberty from the ninth to the twelfth year, and the faculty of procreation ceases at the

the curiosity of all ages, and the philosophers of every age have attempted the solution. In tracing nature to her most hidden recesses, she becomes too minute or obscure for our inspection; so that we find it impossible to mark her first differences, to discover the point where animal life begins, or the cause that conduces to set it in motion. We know little more than that the greatest number of animals require the concurrence of a male and female to reproduce their kind; and that these distinctly and invariably are found to beget creatures of their own species. Curiosity has, therefore, been active in trying to discover the immediate result of this union; how far either sex contributes to the bestowing animal life, and whether it be to the male or female, that we are most indebted for the privilege of our existence.

Hippocrates has supposed that fecundity proceeded from the mixture of the seminal liquor of both sexes, each of which equally contributes to the formation of the incipient animal. Aristotle, on the other hand, would have the seminal liquor in the male alone to contribute to this purpose, while the female supplied the proper nourishment for its support. Such were the opinions of these fathers of philosophy; and these continued to be adopted by the naturalists and schoolmen of succeeding ages, with blind veneration. At length Steno and Harvey, taking anatomy for their guide, gave mankind a nearer view of nature just advancing into animation. These perceived, in all such animals as produced their young alive, two glandular bodies, near the womb, resembling that ovary, or cluster of small eggs, which is found in fowls; and from the analogy between both, they gave these also the name of ovaria. These, as they resembled eggs, they naturally concluded had the same offices; and, therefore, they were induced to think that all animals, of what kind soever, were produced from eggs. At first, however, there was some altercation raised against this system; for, as these ovaria were separate from the womb, it was objected that they could not be any way instrumental in replenishing that organ, with which they did not communicate. But, upon more minute inspection, Fallopius, the anatomist, perceived two tubular vessels depending from the womb, which, like the horns of a snail, had a power of erecting themselves, of embracing the ovaria, and of receiving the eggs, in order to be fecundated by the seminal liquor. This discovery seemed, for a long time after, to fix the opinions of philosophers. The doctrine of Hippocrates was re-established, and the chief business of generation was ascribed to the female. This was for a long time the established opinion of the schools; but Leuwenhoeck, once more, shook the whole system, and produced a new schism among the lovers of speculation. Upon examining the seminal liquor of a great variety of male animals with microscopes, which helped his sight more than that of any of his successors, he perceived therein infinite numbers of little living creatures, like tadpoles, very brisk, and floating in the fluid with a seeming voluntary motion. Each of these, therefore, was thought to be the rudiments of an animal, similar to that from which it was produced; and this only required a reception from the female, together with proper nourishment, to complete its growth. The business of generation was now, therefore, given back to the male a second time, by many; while others suspended their assent, and chose rather to confess ignorance than to embrace error.[1]

In this manner has the dispute continued for several ages, some accidental discovery serving, at intervals, to renew the debate, and revive curiosity. It was a subject where speculation could find much room to display itself; and Mr Buffon, who loved to speculate, would not omit such an opportunity of giving scope to his propensity. According to this most pleasing of all naturalists, the microscope discovers that the seminal liquor, not only of males, but of females also, abounds in these moving little animals which have been mentioned above, and that they appear equally brisk in either fluid. These he takes not to be real animals, but organical particles, which

---

age of twenty-five or thirty. The northern people become puberous much later, and preserve the faculty of engendering for a longer time. This, however, must be understood with some limitation. In Lapland, for example, and other countries near the frozen sea, the inhabitants become marriageable at an early period. On the other hand, the savages of America, who dwell under the line, are late in arriving at puberty. It would thus appear, that as much depends on a physical difference inherent in a particular race as in climate.

The causes which favour the increase of population are the quality, quantity, and species of aliments, the climates, modes of life, occupations, habits, temperaments, &c.

An abundance of nourishment augments the number of men and animals. The years of prosperity are remarkable for the increase of births, the years of scarcity or famine for the diminution. Fecundity is greater in cold than in warm climates. The Icelanders have from fifteen to twenty children, the English or Germans six or eight, the French four or five, and the Spaniards and Italians only two or three. There are, however, individual exceptions, some as regards climate. Thus, for example, the African negresses are remarkably fruitful; and in Egypt women have often two or three infants at at one birth.

[1] Bonet Considerations sur les Corps Organisees. It may be observed that, in the breeding of horses and all kinds of cattle, much more importance is attached to the character of the male than the female.

being simple, cannot be said to be organized themselves, but go to the composition of all organized bodies whatsoever; in the same manner as a tooth, in the wheel of a watch, cannot be called either the wheel or the watch, and yet contributes to the sum of the machine. These organical particles are, according to him, diffused throughout all nature, and to be found not only in the seminal liquor, but in most other fluids in the parts of vegetables, and all parts of animated nature. As they happen, therefore, to be differently applied, they serve to contribute a part of the animal, or the vegetable, whose growth they serve to increase, while the superfluity is thrown off in the seminal liquor of both sexes for the reproduction of other animals or vegetables of the same species. These particles assume different figures, according to the receptacle into which they enter; falling into the womb, they unite into a fœtus; beneath the bark of a tree they pullulate into branches; and, in short, the same particles that first formed the animal in the womb, contribute to increase its growth when brought forth.[1]

To this system it has been objected, that it is impossible to conceive organical substances without being organized; and that, if divested of organization themselves, they could never make an organized body, as an infinity of circles could never make a triangle. It has been objected, that it is more difficult to conceive the transformation of these organical particles, than even that of the animal, whose growth we are inquiring after; and this system, therefore, attempts to explain one obscure thing by another still more obscure.

But an objection, still stronger than these, had been advanced by an ingenious countryman of our own; who asserts, that these little animals, which thus appear swimming and sporting in almost every fluid we examine with a microscope, are not real living particles, but some of the more opaque parts of the fluid that are thus increased in size, and seem to have a much greater motion than they have in reality. For the motion being magnified with the object, the smallest degree of it will seem very considerable; and a being almost at rest may, by these means, be apparently put into violent action. Thus, for instance, if we look upon the sails of a windmill moving at a distance, they appear to go very slow; but, if we approach them, and thus magnify their bulk to our eye, they go round with great rapidity. A microscope, in the same manner, serves to bring our eye close to the object, and thus to enlarge it; and not only increase the magnitude of its parts, but of its motion. Hence, therefore, it would follow, that these organical particles, that are said to constitute the bulk of living nature, are but mere optical illusions; and the system founded on them must, like them, be illusive.

These, and many other objections, have been made to this system; which, instead of enlightening the mind, serve only to show, that too close a pursuit of nature very often leads to uncertainty. Happily, however, for mankind, the most intricate inquiries are generally the most useless. Instead, therefore, of balancing account between the sexes, and attempting to ascertain to which the business of generation most properly belongs, it will be more instructive, as well as amusing, to begin with animal nature, from its earliest retirements, and evanescent outlines, and pursue the incipient creature through all its changes in the womb, till it arrives into open day.

The usual distinction of animals, with respect to their manner of generation, has been into the oviparous and viviparous kinds; or in other words, into those that bring forth an egg, which is afterwards hatched into life, and those that bring forth their young alive and perfect. In one of these two ways all animals were supposed to have been produced, and all other kinds of generation were supposed imaginary or erroneous. But later discoveries have taught us to be more cautious in making general conclusions, and have even induced many to doubt whether animal life may not be produced merely from putrefaction.[2]

Indeed the infinite number of creatures that putrid substances seem to give birth to, and the variety of little insects seen floating in liquors, by the microscope, appear to favour this opinion. But however this may be, the former method of classing animals can now by no means be admitted, as we find many animals that are produced neither from the womb nor from the shell, but merely from cuttings; so that to multiply life in some creatures, it is sufficient only to multiply the dissection. This being the simplest method of generation, and that in which life seems to require the smallest preparation for its existence, I will begin with it, and so proceed to the two other kinds, from the meanest to the most elaborate.

The earth-worm, the millipedes, the sea-worm, and many marine insects, may be multiplied by being cut in pieces; but the polypus is noted for its amazing fertility; and from hence it will be proper to take the description. The structure of the polypus may be compared to the finger of a glove, open at one end, and closed at the other. The closed end represents the tail of the polypus, with which it serves to fix itself to any substance it happens to be upon; the open end may be compared to the mouth; and, if we conceive six or eight small strings issuing from this end, we shall have a proper idea of its arms, which it can erect, lengthen, and contract, at pleasure, like the horns of a snail. This creature is very voracious, and makes use of its arms as a fisherman does of his net, to catch and entangle such little animals as happen to come within its reach. It lengthens these arms several inches, keeps them separated from each other, and thus occupies a large space in the water in which it resides. These arms, when extended, are as fine as threads of silk, and have a most exquisite degree of feeling. If a small worm happens to get within the sphere of their activity, it is quickly entangled by one of these arms, and, soon after, the other arms come to its aid: these all together shortening, the worm is drawn into the animal's mouth, and quickly devoured, colouring the body as it is swallowed. Thus much is necessary to be observed of this animal's method of living, to show that it is not of the vegetable tribe, but a real animal, performing the functions which other animals are found to perform, and endued with powers that many of them are destitute of. But what is most extraordinary, remains yet to be told; for, if examined with a microscope, there are seen several little specks, like buds, that seem to pullulate from different parts of its body; and these soon after appear to be young polypi, and, like the large polypus, begin to cast their little arms about for prey, in the same manner. Whatever they happen to ensnare is devoured, and gives a colour not only to their own bodies, but to that of the parent; so that the same food is digested, and serves for the nourishment of both. The food of the little one passes into the large polypus, and colours its body; and this, in its turn, digests and swallows its food to pass into theirs. In this manner every polypus has a new colony sprouting from its body: and these new ones, even while attached to the parent animal, become parents themselves, having a smaller colony also budding from them; all, at the same time, busily employed in seeking for their prey, and the food of any one of them serving for the nourishment, and circulating through the bodies, of all the rest. This society, however, is every hour dissolving; those newly produced are seen at intervals to leave the body of the large polypus, and become, shortly after, the head of a beginning colony themselves.

---

[1] Mr Buffon.

[2] Bonet Consid. p. 100.

In this manner the polypus multiplies naturally; but one may take a much readier and shorter way to increase them, and this only by cutting them in pieces. Though cut into thousands of parts, each part still retains its vivacious qualities, and each shortly becomes a distinct and a complete polypus; whether cut lengthways, or crossways, it is all the same; this extraordinary creature seems a gainer by our endeavours, and multiplies by apparent destruction. The experiment has been tried, times without number, and still attended with the same success.

Here, therefore, naturalists, who have been blamed for the cruelty of their experiments upon living animals, may now boast of their increasing animal life, instead of destroying it. The production of the polypus is a kind of philosophical generation. The famous Sir Thomas Brown hoped one day to be able to produce children by the same method as trees are produced: the polypus is multiplied in this manner; and every philosopher may thus, if he please, boast of a very numerous, though, I should suppose, a very useless progeny.[1]

---

[1] The structure and habits of the fresh-water Hydra first attracted the attention of Leeuwenhoek, in the year 1703, and were afterwards studied with singular ingenuity and success by Trembley of Geneva, in 1739. The discoveries of this naturalist may be considered as having laid the foundation of Zoophytology, and prepared the way for those researches into the anatomy and physiology of the invertebrate animals, which in recent years have shed a new light on the philosophy of organization. The observations of Trembley were confirmed by those of Henry Baker in England, in 1743. The study of zoophytes was, about the same period, prosecuted in a philosophical spirit by John Ellis, a London merchant, who had the merit of proving the animal nature of corals and corallines, including certain marine productions which had previously been classified amongst vegetables. By examining these structures in a living state, he was able to detect the alliance of the animals to the hydra, and to establish the fact of the supposed plant consisting in reality of a community of living beings, organically connected with the denticles or cells of the zoophyte, from which they could not be removed; and that although each cell was appropriated to a single individual, every one of the polypes was united "by a tender thready line to the fleshy part that occupies the middle of the whole coralline," and in this manner connected with all the individuals of the coralline. Ellis first communicated his views to the Royal Society in 1752, and encouraged by the reception they met with, he prosecuted his researches with fresh ardour and sagacity, and embodied his discoveries in 1754, in his "Essay towards a natural history of the corallines, and other marine productions of the like kind," which is still a work held in deserved repute and authority. The common fresh-water hydra (*H. viridis*), may be readily procured in summer from the surface of duck-weed, or other aquatic plants growing in ponds and canals; and when it is placed in a phial of pure water, the observer may study some of the phenomena which, a century ago, afforded so much interest to naturalists. The improvement of the microscope has revealed an elaborate system of offensive weapons with which this apparently simple gelatinous being is provided. Its tentacles are armed with a series of warty excrescences, each containing a minute calcareous dart, pointed at its extremity, and bifid at its base. This dart can be

This method of generation, from cuttings, may be considered as the most simple kind, and is a strong instance of the little pains Nature takes in the formation of her lower and humbler productions. As the removal of these from inanimate into animal existence is but small, there are but few preparations made for their journey. No organs of generation seem provided, no womb to receive, no shell to protect them in their state of transition. The little reptile is quickly fitted for all the offices of its humbler sphere, and in a very short time, arrives at the height of its contemptible perfection.

The next generation is of those animals that we see produced from the egg. In this manner all birds, most fishes, and many of the insect tribes, are brought forth. An egg may be considered as a womb detached from the body of the parent animal, in which the embryo is but just beginning to be formed. It may be regarded as a kind of incomplete delivery, in which the animal is disburthened of its young before its perfect formation. Fishes and insects, indeed, most usually commit the care of their eggs to hazard: but birds, which are more perfectly formed, are found to hatch them into maturity by the warmth of their bodies. However, any other heat, of the same temperature, would answer the end as well; for either the warmth of the sun, or of a stove, is equally efficacious in bringing the animal in the egg to perfection.[1] In this respect, therefore, we may consider

---

projected and retracted at will, and when plunged into the tissues of the small worms and other creatures upon which the hydra feeds, is supposed to eject a poisonous fluid so subtle and potent as instantly to stupefy, if not to kill, the animal. The hydra propagates by ova and by spontaneous fission, and may be multiplied and metamorphosed, as described in the text, by artificial incision. The cylindrical body of the animal is often seen with young hydræ attached to it, with their tentacles extended like fishing lines, in search of prey. The young individuals ultimately drop off from the parent, and commence an independent existence. In order to understand the structure of a compound zoophyte, such as the Sertularia, we have only to imagine the successive growths of new individuals to remain permanently attached to the parent stem, giving forth in their turn buds, becoming permanent branches. In the great marine family of the *Sertulariadæ*, the germ first developes a single hydra-like polype, consisting of a slender stem or body of granular flesh, inclosing a stomachal cavity, the orifice of which is surrounded by a circle of tentacles. Another bud soon projects from the side, which shoots upwards, and spreads out a similar coronet of tentacles, and in this manner one bud after another appears alternately on the sides of the rising stem, until the structure assumes the shape of a plant, with branching stalks, crowded with thousands of cells, forming a colony or commonwealth of active and hungry polypes, contributing to the nutrition and growth of the polypidom. The structures are as diversified in their forms as the species of polypes producing them. The Sea Anemone, many beautiful species of which are now domesticated in the aquarium, and are familiar to the frequenters of the sea shore, is essentially a hydra, being a cylindrical column of flesh, with the free or upper part truncate, and surrounded by one or more circular rows of tentacles. The interior is hollowed to form a stomach, which is closed below by the disk of the body. The space between the stomach and the outer walls of the body is occupied by a series of fleshy partitions which are set in a radiating manner, dividing the space into separate chambers, in which are situated the ovaries. The tentacles are furnished in many of the species with poison threads, which the animal throws out like a *lasso* in the act of seizing and stunning its prey. Corals are the products of animals closely allied to the sea anemone; and we have only to suppose calcareous particles to be deposited on the radiating partitions of the body of this animal, and we should have the starry forms of the Madrepore and other coral-building zoophytes. The Flustra, or Sea-Mat, the Cellularia, and allied genera, resembling zoophytes in their appearance and habits, are the dwellings of animals of higher organization than the hydraform polype, and approach the structure of the lower forms of mollusca. They have received the name of Bryozoa, or moss-like animals, from the peculiar aspect presented by their accumulated cells, which cover or encrust stones and shells on the sea shore.

[1] It is indispensable to hatching, that an equable temperature be kept up of about 96° Fahr. or 32° Réaum., for at lower temperatures the living principle appears to become torpid and unable to assimilate the nourishment provided for developing the embryo. Proceeding upon this principle, the Egyptians, as well as those who have tried the experiment in Europe, have succeeded by means of artificial heat in hatching eggs without any aid from the mother bird.

Modern travellers, who mention the art as practised in Egypt, are very deficient in their details; but we ought to wonder the less at this when Father Sicard informs us that it is kept a secret even in Egypt, and is only known to the inhabitants of the village of Berme, and a few adjoining places in the Delta, who leave it as an heir-loom to their children, forbidding them to impart it to strangers. When the beginning of autumn, the season most favourable for hatching, approaches, the people of this village disperse themselves over the country, each taking the management of a number of eggs intrusted to his care by those acquainted with the art.

According to the best descriptions of the Egyptian *mamal*, or hatching-oven, it is a brick structure about nine feet high. The middle is formed into a gallery about three feet wide and eight feet high, extending from one end of the building to the other. This gallery forms the entrance to the oven, and commands its whole extent, facilitating the various operations indispensable for keeping the eggs at the proper degree of warmth. On each side of this gallery there is a double row of rooms, every room on the ground-floor having one over it of precisely the same dimensions, namely, three feet in height, four or five in breadth, and twelve or fifteen in length. These have a round hole for an entrance of about a foot and a half in diameter, wide enough for a man to creep through; and into each are put four or five thousand eggs. The number of rooms in one mamal varies from three to twelve; and the building is adapted, of course, for hatching from forty to eighty thousand eggs, which are not laid on the bare brick floor of the oven, but upon a mat, or bed of flax, or other non-conducting material.

In each of the upper rooms is a fire-place for warming the lower room, the heat being communicated through a large hole in the centre. The fire-place is a sort of gutter, two inches deep and six wide, on the generation from the egg as inferior to that in which the animal is brought forth alive. Nature has taken care of the viviparous animal in every stage of its existence. That force which separates it from the parent separates it from life; and the embryo is shielded with unceasing protection till it arrives at exclusion. But it is different with the little animal in the egg; often totally neglected by the parent, and always separable from it, every accident may retard its growth, or even destroy its existence. Besides, art or accident, also, may bring this animal to a state of perfection; so that it never can be considered as a complete work of nature, in which so much is left for accident to finish or destroy.

But however inferior this kind of generation may be, the observation of it will afford great insight into that of nobler animals, as we can here watch the progress of the growing embryo in every period of its existence, and catch it in those very moments when it first seems stealing into motion. Malpighi and Haller have been particularly industrious on this subject; and with a patience almost equalling that of the sitting hen, have attended incubation in all its stages. From them, therefore, we have an amazing history of the chicken in the egg, and of its advances into complete formation.

It would be methodically tedious to describe those parts of the egg which are well known and obvious; such as its shell, its white, and its yolk; but the disposition of these is not so apparent. Immediately under the shell lies that common membrane or skin, which lines it on the inside, adhering closely to it everywhere, except at the broad end, where a little cavity is left, that is filled with air which increases as the animal within grows larger. Under this membrane are contained two whites, though seeming to us to be only one, each wrapped up in a membrane of its own, one white within the other. In the midst of all is the yolk, wrapped up likewise in its own membrane. At each end of this are two ligaments, called *chalazæ*, which are, as it were, the poles of this microcosm, being white dense substances, made from the membranes, and serving to keep the white and the yolk in their places. It was the opinion of Mr Derham that they served also for another purpose; for a line being drawn from one ligament to the other, would not pass directly through the middle of the yolk, but rather towards one side, and would divide the yolk into two unequal parts, by which means these ligaments serve to keep the smallest side of the yolk always uppermost; and in this part he supposed the cicatricula, or first speck of life, to reside; which by being uppermost, and consequently next the hen, would be thus in the warmest situation. But this is rather fanciful than true, the incipient animal being found in all situations, and not particularly influenced by any.[1] The cicatricula, which is the part where the animal first begins to show signs of life, is not unlike a vetch, or a lentil, lying on one side of the yolk, and within its membrane. All these contribute to the little animal's convenience or support: the outer membranes and ligaments preserve the fluids in their proper places; the white serves as nourishment, and the yolk, with its membranes, after a time becomes a part of the animal's body.[2] This is a description of a hen's egg, and answers to that of all others, how large or how small soever.

Previous to putting the eggs to the hen, our philosophers first examined the cicatricula,

---

edge of the floor, sometimes all round, but for the most part only on two of its sides. As wood or charcoal would make too quick a fire, they burn the dung of cows or camels, mixed with straw, formed into cakes and dried. The doors which open into the gallery serve for chimneys to let out the smoke, which finally escapes through openings in the arch of the gallery itself. The fire in the gutters is only kept up, according to some, for an hour in the morning and an hour at night, which they call the dinner and supper of the chickens; while others say it is lighted four times a-day. The difference probably depends on the temperature of the weather. When the smoke of the fires has subsided, the openings into the gallery from the several rooms are carefully stuffed with bundles of coarse tow, by which the heat is more effectually confined than it could be by a wooden door.

When the fires have been continued for an indefinite number of days—eight, ten, or twelve, according to the weather—they are discontinued, the heat acquired by the oven being then sufficient to finish the hatching, which requires in all twenty-one days, the same time as when eggs are naturally hatched by a hen. About the middle of this period a number of the eggs in the lower are moved into the upper rooms, in order to give the embryos greater facility in making their exit from the shell, than they would have if a number of eggs were piled up above them.

The number of ovens dispersed in the several districts of Egypt has been estimated at 386; and this number can never be either increased or diminished without the circumstance being known, as it is indispensable for each mamal to be managed by a Bermean, none of whom are permitted to practise their art without a certified license from the aga of Berme, who receives ten crowns for each license. If, then, we take into account that six or eight broods are annually hatched in each oven, and that each brood consists of from 40,000 to 80,000, we may conclude that the gross number of chickens which are every year hatched in Egypt amounts to nearly 100,000,000. They lay their account with losing about a third of all the eggs put into the ovens. The Bermean, indeed, guarantees only two-thirds of the eggs with which he is entrusted by the undertaker, so that out of 45,000 eggs he is obliged to return no more than 30,000 chickens. If he succeeds in hatching these, the overplus becomes his perquisite, which he adds to the sum of thirty or forty crowns, besides his board, that is paid him for his six months' work.

[1] Haller.

[2] Ibid.

or little spot, already mentioned; and which may be considered as the most important part of the egg. This was found in those that were impregnated by the cock to be large; but in those laid without the cock very small. It was found by the microscope, to be a kind of bag, containing a transparent liquor, in the midst of which the embryo was seen to reside. The embryo resembled a composition of little threads, which the warmth of future incubation tended to enlarge by varying and liquifying the other fluids contained within the shell, and thus pressing them either into the pores or tubes of their substance.

Upon placing the eggs in a proper warmth,[1] either under the sun or in a stove, after six hours the vital speck begins to dilate, like the pupil of the eye. The head of the chicken is distinctly seen, with the back bone, something resembling a tadpole, floating in its ambient fluid, but as yet seeming to assume none of the functions of animal life. In about six hours more the little animal is seen more distinctly; the head becomes more plainly visible, and the vertebræ of the back more easily perceivable. All these signs of preparation for life are increased in six hours more: and at the end of twenty-four, the ribs begin to take their places, the neck begins to lengthen, and the head to turn to one side.

At this time,[2] also, the fluids in the egg seem to have changed place; the yolk, which was before in the centre of the shell, approaches nearer to the broad end. The watery part of the white is in some measure evaporated through the shell, and the grosser part sinks to the small end. The little animal appears to turn towards the part of the broad end, in which a cavity has been described, and with its yolk seems to adhere to the membrane there. At the end of forty hours the great work of life seems fairly begun, and the animal plainly appears to move; the backbone, which is of a whitish colour, thickens; the head is turned still more on one side; the first rudiments of the eye begin to appear, the heart beats, and the blood begins already to circulate. The parts, however, as yet are fluid; but by degrees, become more and more tenacious, and harden into a kind of jelly. At the end of two days, the liquor in which the chicken swims, seems to increase; the head appears with two little bladders, in the place of eyes; the heart beats in the manner of every embryo, where the blood does not circulate through the lungs. In about fourteen hours after this, the chicken is grown more strong; its head however is still bent downwards; the veins and arteries begin to branch, in order to form the brain; and the spinal marrow is seen stretching along the backbone. In three days the whole body of the chicken appears bent; the head with its two eye-balls with their different humours, now distinctly appear; and five other vesicles are seen, which soon unite to form the rudiments of the brain. The outlines also of the thighs and wings begin to be seen, and the body begins to gather flesh. At the end of the fourth day, the vesicles, that go to form the brain, approach each other; the wings and thighs appear more solid; the whole body is covered with a jelly-like flesh; the heart that was hitherto exposed, is now covered up within the body, by a very thin transparent membrane; and, at the same time, the umbilical vessels, that unite the animal to the yolk, now appear to come forth from the abdomen. After the fifth and sixth days, the vessels of the brain begin to be covered over; the wings and thighs lengthen; the belly is closed up and tumid; the liver is seen within it very distinctly, not yet grown red, but of a very dusky white; both the ventricles of the heart are discerned, as if they were two separate hearts, beating distinctly; the whole body of the animal is covered over; and the traces of the incipient feathers are already to be seen. The seventh day, the head appears very large; the brain is covered entirely over; the bill begins to appear betwixt the eyes, and the wings, the thighs and the legs, have acquired their perfect figure.[3] Hitherto, however, the animal appears as if it had two bodies; the yolk is joined to it by the umbilical vessels that come from the belly, and is furnished with its vessels, through which the blood circulates, as through the rest of the body of the chicken, making a bulk greater than that of the animal itself. But towards the end of incubation, the umbilical vessels shorten the yolk, and with it the intestines are thrust up into the body of the chicken by the action of the muscles of the belly; and the two bodies are thus formed into one. During this state, all the organs are found to perform their secretions; the bile is found to be separated as in grown animals; but it is fluid, transparent, and without bitterness: and the chicken then also appears to have lungs. On the tenth the muscles of the wings appear, and the feathers begin to push out. On the eleventh, the heart, which hitherto had appeared divided, begins to unite; the arteries which belong to it join into it, like the fingers into the palm of the hand. All these appearances only come more into view, because the fluids the vessels had hitherto secreted were more transparent; but as the colour of the fluids deepen, their operations and circulations are more distinctly seen. As the animal thus, by the eleventh day completely formed, begins to gather strength, it becomes more uneasy in its situation, and exerts its animal powers with increasing force. For some time before it is able to break the shell in which it is imprisoned, it is heard to chirrup, receiving a sufficient quantity of air for this purpose, from that cavity which lies between the membrane and the shell, and which must contain air to resist the external pressure. At length upon the twentieth day, in some birds sooner, and later in others, the enclosed animal breaks the shell, within which it has been confined, with its beak; and by repeated efforts, at last procures its enlargement.

---

[1] Malpighi.

[2] Harvey

[3] Haller.

From this little history we perceive, that those parts which are most conducive to life are the first that are begun; the head and the back-bone, which no doubt enclose the brain and the spinal marrow, though both are too limpid to be discerned, are the first that are seen to exist: the beating of the heart is perceived soon after: the less noble parts seem to spring from these; the wings, the thighs, the feet, and lastly the bill. Whatever, therefore, the animal has double, or whatever it can live without the use of, these are latest in production; Nature first sedulously applying to the formation of the nobler organs, without which life would be of short continuance, and would be begun in vain.

The resemblance between the beginning animal in the egg, and the embryo in the womb, is very striking; and this similitude has induced many to assert, that all animals are produced from eggs in the same manner. They consider an egg excluded from the body by some, and separated into the womb by others, to be actions merely of one kind; with this only difference, that the nourishment of the one is kept within the body of the parent, and increases as the embryo happens to want the supply; the nourishment of the other is prepared all at once, and sent out with the beginning animal, as entirely sufficient for its future support. But leaving this to the discussion of anatomists, let us proceed rather with facts than dissertations; and, as we have seen the progress of an oviparous animal, or one produced from the shell, let us likewise trace that of a viviparous animal, which is brought forth alive. In this investigation, Graaf has, with a degree of patience characteristic of his nation, attended the progress and increase of various animals in the womb, and minutely marked the changes they undergo. Having dissected a rabbit, half an hour after impregnation, he perceived the horns of the womb, that go to embrace and communicate with the ovary, to be more red than before; but no other change in the rest of the parts. Having dissected another six hours after, he perceived the follicules, or the membrane covering the eggs contained in the ovary, to become reddish. In a rabbit dissected after twenty-four hours, he perceived in one of the ovaries, three follicules, and in the other, five, that were changed; having become, from transparent, dark and reddish. In one dissected after three days, he perceived the horns of the womb very strictly to embrace the ovaries; and he observed three of the follicules in one of them, much longer and harder than before; pursuing his inquisition, he also found two of the eggs actually separated into the horns of the womb, and each about the size of a grain of mustard-seed; these little eggs were each of them inclosed in a double membrane, the inner parts being filled with a very limpid liquor. After four days, he found in one of the ovaries four, and, in the other, five follicules, emptied of their eggs; and, in the horns correspondent to these, he found an equal number of eggs thus separated: these eggs were now grown larger than before, and somewhat of the size of sparrow-shot. In five days, the eggs were grown to the size of duck-shot, and could be blown from the part of the womb where they were, by the breath. In seven days, these eggs were found of the size of a pistol-bullet, each covered with its double membrane, and these much more distinct than before. In nine days, having examined the liquor contained in one of these eggs, he found it from a limpid colour less fluid, to have got a light cloud floating upon it. In ten days, this cloud began to thicken, and to form an oblong body, of the figure of a little worm: and, in twelve days, the figure of the embryo was distinctly to be perceived, and even its parts came into view. In the region of the breast he perceived two bloody specks; and two more that appeared whitish. Fourteen days after impregnation, the head of the embryo was become large and transparent, the eyes prominent, the mouth open, and the rudiments of the ears beginning to appear; the back-bone, of a whitish colour, was bent towards the breast; the two bloody specks being now considerably increased, appeared to be nothing less than the outlines of the two ventricles of the heart; and the two whitish specks on each side, now appeared to be the rudiments of the lungs; towards the region of the belly, the liver began to be seen, of a reddish colour, and a little intricate mass, like ravelled thread, discerned, which soon appeared to be the stomach and the intestines; the legs soon after began to be seen, and to assume their natural positions: and from that time forth, all the parts being formed, every day only served to develope them still more, until the thirty-first day, when the rabbit brought forth her young, completely fitted for the purposes of their humble happiness.

Having thus seen the stages of generation in the meaner animals, let us take a view of its progress in man; and trace the feeble beginnings of our own existence. An account of the lowliness of our own origin, if it cannot amuse, will at least serve to humble us; and it may take from our pride, though it fails to gratify our curiosity. We cannot here trace the variations of the beginning animal, as in the former instances; for the opportunities of inspection are but few and accidental: for this reason, we must be content often to fill up the blanks of our history with conjecture. And, first, we are entirely ignorant of the state of the infant in the womb, immediately after conception; but we have good reason to believe, that it proceeds, as in most other animals, from the egg.[1] Anatomists inform us, that four days after conception, there is found in the womb an oval substance, about the size of a small pea, but longer one way than the other; this little body is formed by an extremely fine membrane, inclosing a liquor a good deal resembling the white of an egg: in this may, even then, be perceived, several small fibres, united together, which form the first rudiments of the embryo. Beside these, are seen another set of fibres, which soon after become the placenta, or that body by which the animal is supplied with nourishment.

Seven days after conception, we can readily distinguish by the eye, the first lineaments of the child in the womb. However, they are as yet without form; showing at the end of seven days pretty much such an appearance as that of the chicken after four and twenty hours, being a small jelly-like mass, yet exhibiting the rudiments of the head; the trunk is barely visible: there likewise is to be discerned a small assemblage of fibres issuing from the body of the infant, which afterwards become the blood-vessels that convey nourishment from the placenta to the child while inclosed in the womb.

Fifteen days after conception, the head becomes distinctly visible, and even the most prominent features of the visage begin to appear. The nose is a little elevated: there are two black specks in the place of eyes; and two little holes where the ears are afterwards seen. The body of the embryo also is grown larger; and both above and below, are seen two little protuberances, which mark the places from whence the arms and thighs are to proceed. The length of the whole body at this time is less than half an inch.

At the end of three weeks, the body has received very little increase; but the legs and feet, with the hands and arms, are become apparent. The growth of the arms is more speedy than that of the legs; and the fingers are sooner separated than the toes. About this time the internal parts are found, upon dissection, to become distinguishable. The places of the bones are marked by small thread-like substances, that are yet more fluid even than a jelly. Among them, the ribs are distinguishable, like threads also, disposed on each side of the spine; and even the fingers and toes scarcely exceed hairs in thickness.

In a month, the embryo is an inch long; the body is bent forward, a situation which it almost always assumes in the womb, either because a posture of this kind is the most easy, or because it takes up the least room. The human figure is now no longer doubtful: every part of the face is distinguishable; the body is sketched out; the bowels are to be distinguished as threads; the bones are still quite soft, but in some places beginning to assume a greater rigidity; the blood-vessels that go to the placenta, which, as was said, contributes to the child's nourishment, are plainly seen issuing from the navel (being therefore called the *umbilical vessels*), and going to spread themselves upon the placenta. According to Hippocrates, the male embryo developes sooner than the female: he adds, that at the end of thirty days, the parts of the body of the male are distinguishable; while those of the female are not equally so till ten days after.

In six weeks, the embryo is grown two inches long; the human figure begins to grow every day more perfect; the head being still much larger, in proportion to the rest of the body; and the motion of the heart is perceived almost by the eye. It has been seen to beat in an embryo of fifty days old, a long time after it had been taken out of the womb.

In two months, the embryo is more than two inches in length. The ossification is perceivable in the arms and thighs, and in the point of the chin, the under jaw being greatly advanced before the upper. These parts, however, may as yet be considered as bony points, rather than as bones. The umbilical vessels, which before went side by side, are now begun to be twisted, like a rope, one over the other, and go to join with the placenta, which, as yet, is but small.

In three months, the embryo is above three inches long, and weighs about three ounces. Hippocrates observes, that not till then the mother perceives the child's motion: and he adds, that in female children, the motion is not observable till the end of four months. However, this is no general rule, as there are women who assert, that they perceived themselves to be quick with child, as their expression is, at the end of two months; so that this quickness seems rather to arise from the proportion between the child's strength and the mother's sensibility, than from any determinate period of time. At all times, however, the child is equally alive; and, consequently, those juries of matrons that are to determine upon the pregnancy of criminals should not inquire whether the woman be quick, but whether she be with child; if the latter be perceivable, the former follows of course.

---

[1] This history of the child in the womb is translated from Mr Buffon with some alterations.—*Note by Goldsmith.*

Four months and a half after conception, the embryo is from six to seven inches long. All the parts are so augmented, that even their proportions are now distinguishable. The very nails begin to appear upon the fingers and toes: and the stomach and intestines already begin to perform their functions of receiving and digesting. In the stomach is found a liquor similar to that in which the embryo floats: in one part of the intestines, a milky substance; and, in the other, an excrementitious. There is found, also, a small quantity of bile in the gall bladder; and some urine in its own proper receptacle. By this time, also, the posture of the embryo seems to be determined. The head is bent forward, so that the chin seems to rest upon its breast; the knees are raised up towards the head, and the legs bent backwards, somewhat resembling the posture of those who sit on their haunches. Sometimes the knees are raised so high as to touch the cheeks, and the feet are crossed over each other; the arms are laid upon the breast, while one of the hands, and often both, touch the visage; sometimes the hands are shut, and sometimes also the arms are found hanging down by the body. These are the most usual postures which the embryo assumes; but these it is frequently known to change; and it is owing to these alterations that the mother so frequently feels those twitches, which are usually attended with pain.

The embryo, thus situated, is furnished by nature with all things proper for its support; and, as it increases in size, its nourishment also is found to increase with it. As soon as it first begins to grow in the womb, that receptacle, from being very small, grows larger; and, what is more surprising, thicker every day. The sides of a bladder, as we know, the more they are distended, the more they become thin. But here the larger the womb grows, the more it appears to thicken. Within this the embryo is still farther involved, in two membranes called the *chorion* and *amnios*; and floats in a thin transparent fluid, upon which it seems, in some measure, to subsist However, the great storehouse, from whence its chief nourishment is supplied, is called the *placenta*; a red substance somewhat resembling a sponge, that adheres to the inside of the womb, and communicates, by the umbilical vessels, with the embryo. These umbilical vessels, which consist of a vein and two arteries, issue from the navel of the child, and are branched out upon the placenta; where they, in fact, seem to form its substance; and, if I may so express it, to suck up their nourishment from the womb, and the fluids contained therein. The blood thus received from the womb, by the placenta, and communicated by the umbilical vein to the body of the embryo, is conveyed to the heart; where, without ever passing into the lungs, as in the born infant, it takes a shorter course; for entering the right auricle of the heart, instead of passing up into the pulmonary artery, it seems to break this partition, and goes directly through the body of the heart, by an opening called the *foramen ovale*, and from thence to the aorto, or great artery; by which it is driven into all parts of the body. Thus we see the placenta, in some measure, supplying the place of lungs; for as the little animal can receive no air by inspiration, the lungs are therefore useless. But we see the placenta converting the fluid of the womb into blood, and sending it, by the umbilical vein, to the heart; from whence it is despatched by a quicker and shorter circulation through the whole frame.

In this manner the embryo reposes in the womb; supplied with that nourishment which is fitted to its necessities, and furnished with those organs that are adapted to its situation. As its sensations are but few, its wants are in the same proportion; and it is probable that a sleep, with scarcely any intervals, marks the earliest period of human life. As the little creature, however, gathers strength and size, it seems to become more wakeful and uneasy; even in the womb it begins to feel the want of something it does not possess; a sensation that seems coeval with man's nature, and never leaves him till he dies. The embryo even then begins to struggle for a state more marked by pleasure and pain, and, from about the sixth month, begins to give the mother warning of the greater pain she is yet to endure. The continuation of pregnancy, in woman, is usually nine months; but there have been many instances when the child has lived that was born at seven; and some are found to continue pregnant a month above the usual time. When the appointed time approaches, the infant, that has for some months been giving painful proofs of its existence, now begins to increase its efforts for liberty. The head is applied downward, to the aperture of the womb, and by reiterated efforts it endeavours to extend the same: these endeavours produce the pain, which all women, in labour, feel in some degree; those of strong constitutions the least, those most weakly the most severely; since we learn, that the women of Africa always deliver themselves, and are well a few hours after; while those of Europe require assistance, and recover more slowly. Thus the infant, still continuing to push with its head forward, by the repetition of its endeavours, at last succeeds, and issues into life. The blood which had hitherto passed through the heart, now takes a wider circuit; and the foramen ovale closes; the lungs, that had till this time been inactive, now first begin their functions; the air rushes in to distend them; and this produces the first sensation of pain, which the infant expresses by a shriek; so that the beginning of our lives, as well as the end, is marked with anguish.[1]

From comparing these accounts, we perceive that the most laboured generation is the most perfect; and that the animal, which, in proportion to its bulk, takes the longest time for production, is always the most complete when finished. Of all others, man seems the slowest in coming into life, as he is the slowest in coming to perfection; other animals, of the same bulk, seldom remain in the womb above six months, while he continues nine; and even after his birth, appears more than any other to have his state of imbecility prolonged.

We may observe also, that that generation is the most complete, in which the fewest animals are produced. Nature, by attending to the production of one at a time, seems to exert all her efforts in bringing it to perfection; but, where this attention is divided, the animals so produced come into the world with partial advantages. In this manner twins are never, at least while infants, so large, or so strong, as those that come singly into the world; each having, in some measure, robbed the other of its right; as that support, which Nature meant for one, has been prodigally divided.

In this manner, as those animals are the best that are produced singly, so we find that the noblest animals are ever the least fruitful. These are seen usually to bring forth but one at a time, and to place all their attention upon that alone. On the other hand, all the oviparous kinds produce in amazing plenty; and even the lower tribes of viviparous animals increase in a seeming proportion to their minuteness and imperfection. Nature seems lavish of life in the lower orders of the creation; and, as if she meant them entirely for the use of the nobler races, she appears to have bestowed greater in multiplying the number than in completing the kind. In this manner, while the elephant and the horse bring forth but one at a time, the spider and the beetle are seen to produce a thousand: and even among the smaller quadrupeds, all the inferior kinds are extremely fertile; any one of these being found, in a very few months, to become the parent of a numerous progeny.

In this manner, therefore, the smallest animals multiply in the greatest proportion; and we have reason to thank Providence that the most formidable animals are the least fruitful. Had the lion and the tiger the same degree of fecundity with the rabbit or the rat, all the arts of man would be unable to oppose these fierce invaders; and we should soon perceive them become the tyrants of those who claim the lordship of the creation. But Heaven, in this respect, has wisely consulted the advantage of all. It has opposed to man only such enemies as he has art and strength to conquer; and as large animals require proportional supplies, nature was unwilling to give new life, where it, in some measure, denied the necessary means of subsistence.

In consequence of this pre-established order, the animals that are endowed with the most perfect methods of generation, and bring forth but one at a time, seldom begin to procreate till they have almost acquired their full growth. On the other hand, those which bring forth many, engender before they have arrived at half their natural size. The horse and the bull come almost to perfection before they begin to generate; the hog and the rabbit scarcely leave the teat before they become parents themselves. In whatever light, therefore, we consider this subject, we shall find that all creatures approach most to perfection, whose generation most nearly resembles that of man. The reptile produced from cutting is but one degree above the vegetable. The animal produced from one egg is a step higher in the scale of existence; that class of animals which are brought forth alive, are still more exalted. Of these, such as bring forth one at a time are the most complete; and the foremost of these stands Man, *the great master of all*, who seems to have united the perfections of all the rest in his formation.

CHAP. III.

THE INFANCY OF MAN.

When we take a survey of the various classes of animals, and examine their strength, their beauty, or their structure, we shall find man to possess most of those advantages united, which the rest enjoys partially. Infinitely superior to all others in the powers of the understanding, he is also superior to them in the fitness and proportions of his form. He would, indeed, have been one of the most miserable beings upon earth, if with a sentient mind he was so formed as to be incapable of obeying its impulse; but Nature has otherwise provided; as with the most extensive intellects to command, she has furnished him with a body the best fitted for obedience.

---

[1] Bonnet. Contemplat. de la Nature, vol. i. p. 212.

In infancy,[1] however, that mind and this body form the most helpless union in all animated nature: and, if any thing can give us a picture of complete imbecility, it is a man when just come into the world. The infant just born stands in need of all things, without the power of procuring any. The lower races of animals, upon being produced, are active, vigorous, and capable of self-support; but the infant is obliged to wait in helpless expectation; and its cries are its only aid to procure subsistence.

An infant just born may be said to come from one element into another: for, from the watery fluid in which it was surrounded, it now emerges into air; and its first cries seem to imply how greatly it regrets the change. How much longer it could have continued in a state of almost total insensibility in the womb, it is impossible to tell: but it is very probable that it could remain there some hours more. In order to throw some light upon this subject, Mr Buffon so placed a pregnant bitch, as that her puppies were brought forth in warm water, in which he kept them above half an hour at a time. However, he saw no change in the animals, thus newly brought forth; they continued the whole time vigorous; and, during the whole time, it is very probable that the blood circulated through the same channels through which it passed while they continued in the womb.

Almost all animals have their eyes closed,[2] for some days after being brought into the world. The infant opens them the instant of its birth. However, it seems to keep them fixed and idle; they want that lustre which they acquire by degrees; and if they happen to move, it is rather an accidental gaze, than an exertion of the act of seeing. The light alone seems to make the greatest impression upon them. The eyes of infants are sometimes found turned to the place where it is strongest; and the pupil is seen to dilate and diminish, as in grown persons, in proportion to the quantity it receives. But still the infant is incapable of distinguishing objects; the sense of seeing, like the rest of the senses, requires an habit before it becomes any way serviceable. All the senses must be compared with each other, and must be made to correct the defects of one another, before they can give just information. It is probable, therefore, that if the infant could express its own sensations, it would give a very extraordinary description of the illusions which it suffers from them. The sight might, perhaps, be represented as inverting objects, or multiplying them; the hearing, instead of conveying one uniform tone, might be said to bring up an interrupted succession of noises; and the touch apparently would divide one body into as many as there are fingers that grasp it. But all these errors are lost in one confused idea of existence; and it is happy for the infant that it then can make but very little use of its senses, when they could serve only to bring it false information.

If there be any distinct sensations, those of pain seem to be much more frequent and stronger than those of pleasure. The infant's cries are sufficient indications of the uneasiness it must, at every interval, endure; while, in the beginning, it has got no external marks to testify its satisfactions. It is not till after forty days that it is seen to smile; and not till that time also, that tears begin to appear, its former expressions of uneasiness being always without them. As to any other marks of the passions, the infant being as yet almost without them, it can express none of them in its visage; which, except in the act of crying and laughing, is fixed in a settled serenity. All the other parts of the body seem equally relaxed and feeble; its motions are uncertain and its postures without choice; it is unable to stand upright; its hams are yet bent, from the habit which it received from its position in the womb; it has not strength enough in its arms to stretch them forward, much less to grasp any thing with its hands; it rests just in the posture it is laid; and, if abandoned, must continue in the same position.

Nevertheless, though this be the description of infancy among mankind in general, there are countries and races among whom infancy does not seem marked with such utter imbecility, but where the children, not long after they are born, appear possessed of a greater share of self-support. The children of negroes have a surprising degree of this premature industry; they are able to walk at two months; or at least, to move from one place to another: they also hang to the mother's back without assistance, and seize the breast over her shoulder; continuing in this posture till she thinks proper to lay them down. This is very different in the children of our countries, that seldom are able to walk under a twelvemonth.

---

[1] Buffon, vol. iv. p. 173.

[2] Buffon, vol. iv. p. 173.

The skin of children newly brought forth, is always red, proceeding from its transparency, by which the blood beneath appears more conspicuous. Some say that this redness is greatest in those children that are afterwards about to have the finest complexions; and it appears reasonable that it should be so, since the thinnest skins are always the fairest. The size of a new-born infant is generally about twenty inches, and its weight about twelve pounds. The head is large, and all the members delicate, soft, and puffy. These appearances alter with its age; as it grows older, the head becomes less in proportion to the rest of the body; the flesh hardens; the bones, that before birth grew very thick in proportion, now lengthen by degrees, and the human figure more and more acquires its due dimensions. In such children, however, as are but feeble or sickly, the head always continues too big for the body; the heads of dwarfs being extremely large in proportion.

Infants, when newly born, pass most of their time in sleeping, and awake with crying; excited either by sensations of pain or of hunger. Man, when come to maturity, but rarely feels the want of food, as eating twice or thrice in the four and twenty hours is known to suffice the most voracious: but the infant may be considered as a little glutton, whose only pleasure consists in its appetite; and this, except when it sleeps, it is never easy without satisfying. Thus nature has adapted different desires to the different periods of life; each as it seems most necessary for human support or succession. While the animal is yet forming, hunger excites it to that supply which is necessary for its growth; when it is completely formed, a different appetite takes place, that incites it to communicate existence. These two desires take up the whole attention of different periods, but are very seldom found to prevail strongly together in the same age; one pleasure ever serving to repress the other: and, if we find a person of full age placing a principal part of his happiness in the nature and quantity of his food, we have strong reasons to suspect, that with respect to his other appetites he still retains a part of the imbecility of his childhood.

It is extraordinary, however, that infants, who are thus more voracious than grown persons, are nevertheless more capable of sustaining hunger. We have several instances, in accidental cases of famine, in which the child has been known to survive the parent, and seen clinging to the breast of its dead mother. Their little bodies also are more patient of cold; and we have similar instances of the mother's perishing in the snow, while the infant has been found alive beside her. However, if we examine the internal structure of infants, we shall find an obvious reason for both these advantages. Their blood-vessels are known to be much larger than in adults; and their nerves much thicker and softer: thus being furnished with a more copious quantity of juices, both of the nervous and sanguinary kinds, the infant finds a temporary sustenance in this superfluity, and does not expire till both are exhausted. The circulation also being larger and quicker, supplies it with proportionable warmth, so that it is more capable of resisting the accidental rigours of the weather.

The first nourishment of infants is well known to be the mother's milk; and what is remarkable, the infant has milk in its own breasts, which may be squeezed out by compression: this nourishment becomes less grateful as the child gathers strength; and perhaps, also, more unwholesome. However, in cold countries, which are unfavourable to propagation, and where the female has seldom above three or four children at the most, during her life, she continues to suckle the child for four or five years together. In this manner the mothers of Canada and Greenland are often seen suckling two or three children, of different ages, at a time.

The life of infants is very precarious till the age of three or four, from which time it becomes more secure; and when a child arrives at its seventh year, it is then considered as a more certain life, as Mr Buffon asserts, than at any other age whatever. It appears, from Simpson's Tables, that of a certain number of children born at the same time, a fourth part are found dead at the end of the first year; more than one-third at the end of the second: and, at least, half at the end of the third; so that those who live to be above three years old, are indulged a longer term than half the rest of their fellow-creatures. Nevertheless, life, at that period, may be considered as mere animal existence; and rather a preparation for, than an enjoyment of, those satisfactions, both of mind and body, that make life of real value: and hence it is more natural for mankind to deplore a fellow-creature, cut off in the bloom of life, than one dying in early infancy. The one, by living up to youth, and thus wading through the disadvantageous parts of existence, seems to have earned a short continuance of its enjoyments: the infant, on the contrary, has served but a short apprenticeship to pain; and when taken away, may be considered as rescued from a long continuance of misery.

There is something very remarkable in the growth of the human body.[1] The embryo in the womb continues to increase still more and more till it is born. On the other hand, the child's growth is less every year, till the time of puberty, when it seems to start up of a sudden. Thus, for instance, the embryo, which is an inch long in the first month, grows but one inch and a quarter in the second; it then grows one and a half in the third; two and a half in the fourth; and in this manner it keeps increasing till in the last month of its continuance it is actually found to grow four inches; and in the whole about eighteen inches long. But it is otherwise with the child when born: if we suppose it eighteen inches at that time, it grows in the first year six or seven inches; in the second year, it grows but four inches; in the third year about three; and so on, at the rate of about an inch and a half, or two inches each year, till the time of puberty, when nature seems to make one great last effort, to complete her work, and unfold the whole animal machine.

---

[1] Buffon, vol. vi. p. 173.

The growth of the mind in children seems to correspond with that of the body. The comparative progress of the understanding is greater in infants than in children of three or four years old. If we only reflect a moment on the amazing acquisitions that an infant makes in the first and second years of life, we shall have much cause to wonder. Being sent into a world where every thing is new and unknown, the first months of life are spent in a kind of torpid amazement; an attention distracted by the multiplicity of objects that press to be known. The first labour, therefore, of the little learner is, to correct the illusions of the senses, to distinguish one object from another, and to exert the memory, so as to know them again. In this manner a child of a year old has already made a thousand experiments; all which it has properly ranged, and distinctly remembers. Light, heat, fire, sweets, and bitters, sounds soft or terrible, are all distinguished at the end of a very few months. Besides this, every person the child knows, every individual object it becomes fond of, its rattles, or its bells, may be all considered as so many new lessons to the young mind, with which it has not become acquainted, without repeated exertions of the understanding. At this period of life, the knowledge of every individual object cannot be acquired without the same effort which, when grown up, is employed upon the most abstract idea; every thing the child hears or sees, all the marks and characters of nature, are as much unknown, and require the same attention to attain, as if the reader were set to understand the characters of an Ethiopic manuscript; and yet we see in how short a time the little student begins to understand them all, and to give evident marks of early industry.

It is very amusing to pursue the young mind, while employed in its first attainments. At about a year old the same necessities that first engaged its faculties, increase as its acquaintance with nature enlarges. Its studies, therefore, if I may use the expression, are no way relaxed; for having experienced what gave pleasure at one time, it desires a repetition of it from the same object; and in order to obtain this, that object must be pointed out; here therefore, a new necessity arises which very often neither its little arts nor importunities can remove; so that the child is at last obliged to set about naming the objects it desires to possess or avoid. In beginning to speak, which is usually about a year old, children find a thousand difficulties. It is not without repeated trials that they come to pronounce any one of the letters; nor without an effort of the memory, that they can retain them. For this reason, we frequently see them attempting a sound which they had learned, but forgot; and when they have failed I have often seen their attempt attended with apparent confusion. The letters soonest learned, are those which are most easily formed; thus A and B require an obvious disposition of the organs, and their pronunciation is consequently soon attained. Z and R, which require a more complicated position, are learned with greater difficulty. And this may, perhaps, be the reason why the children in some countries speak sooner than in others; for the letters mostly occurring in the language of one country, being such as are of easy pronunciation, that language is of course more easily attained. In this manner the children of the Italians are said to speak sooner than those of the Germans, the language of the one being smooth and open; that of the other, crowded with consonants, and extremely guttural.

But be this as it will, in all countries children are found able to express the greatest part of their wants by the time they arrive at two years old; and from the moment the necessity of learning new words ceases, they relax their industry. It is then that the mind, like the body, seems every year to make slow advances; and, in order to spur up attention, many systems of education have been contrived.

Almost every philosopher, who has written on the education of children, has been willing to point out a method of his own, chiefly professing to advance the health, and improve the intellects at the same time. These are usually found to begin with nothing right in the common practice; and by urging a total reformation. In consequence of this, nothing can be more wild or imaginary than their various systems of improvement. Some will have the children every day plunged in cold water, in order to strengthen their bodies; they will have them converse with the servants in nothing but the Latin language, in order to strengthen their minds; every hour of the day must be appointed for its own studies, and the child must learn to make these very studies an amusement; till about the age of ten or eleven it becomes a prodigy of premature improvement. Quite opposite to this, we have others, whom the courtesy of mankind also calls *philosophers;* and they will have the child learn nothing till the age of ten or eleven, at which the former has attained so much perfection; with them the mind is to be kept empty, until it has a proper distinction of some metaphysical ideas about truth; and the promising pupil is debarred the use of even his own faculties, lest they should conduct him into prejudice and error. In this manner, some men, whom fashion has celebrated for profound and fine thinkers, have given their hazarded and untried conjectures, upon one of the most important subjects in the world, and the most interesting to humanity. When men speculate at liberty upon innate ideas, or the abstracted distinctions between will and power, they may be permitted to enjoy their systems at pleasure, as they are harmless, although they may be wrong; but when they allege that children are to be every day plunged in cold water, and, whatever be their constitutions, indiscriminately inured to cold and moisture; that they are to be kept wet in the feet, to prevent their catching cold; and never to be corrected when young, for fear of breaking their spirits when old; these are such noxious errors, that all reasonable men should endeavour to oppose them. Many have been the children whom these opinions, begun in speculation, have injured or destroyed in practice; and I have seen many a little philosophical martyr, whom I wished, but was unable to relieve.

If any system be therefore necessary, it is one that would serve to show a very plain point; that very little system is necessary.[1] The natural and common course of education is in every respect the best; I mean that in which the child is permitted to play among its little equals, from whose similar instructions it often gains the most useful stores of knowledge. A child is not idle because it is playing about the fields, or pursuing a butterfly; it is all this time storing its mind with objects, upon the nature, the properties, and the relations of which, future curiosity may speculate.

I have ever found it a vain task to try to make a child's learning its amusement; nor do I see what good end it would answer, were it actually attained. The child, as was said, ought to have its share of play, and it will be benefited thereby; and for every reason also it ought to have its share of labour. The mind, by early labour, will be thus accustomed to fatigues and subordination; and whatever be the person's future employment in life, he will be better fitted to endure it: he will be thus enabled to support the drudgeries of office with content; or to fill up the vacancies of life with variety. The child, therefore, should by times be put to its duty; and be taught to know, that the task is to be done, or the punishment to be endured. I do not object against alluring it to duty by reward; but we well know, that the mind will be more strongly stimulated by pain; and both may, upon some occasions, take their turn to operate. In this manner, a child, by playing with its equals abroad, and labouring with them at school, will acquire more health and knowledge, than by being bred up under the wing of any speculative system-maker; and will be thus qualified for a life of activity and obedience. It is true, indeed, that when educated in this manner, the boy may not be so seemingly sensible and forward as one bred up under solitary instruction; and, perhaps, this early forwardness is more engaging than useful. It is well known, that many of those children who have been such prodigies of literature before ten, have not made an adequate progress to twenty. It should seem, that they only began learning manly things before their time; and, while others were busied in picking up that knowledge adapted to their age and curiosity, these were forced upon subjects unsuited to their years; and, upon that account alone, appearing extraordinary. The stock of knowledge in both may be equal; but with this difference, that each is yet to learn what the other knows.

But whatever may have been the acquisitions of children at ten or twelve, their greatest, and most rapid progress, is made when they arrive near the age of puberty. It is then that all the powers of nature seem at work in strengthening the mind and completing the body; the youth acquires courage, and the virgin modesty; the mind, with new sensations, assumes new powers; it conceives with greater force, and remembers with greater tenacity. About this time, therefore, which is various in different countries, more is learned in one year than in any two of the preceeding; and on this age, in particular, the greatest weight of instruction ought to be thrown.

---

[1] Goldsmith's notions on education will appear to many of the present age to be very loose. It is evident, he would have had little sympathy with the modern formal systems of Bell and Lancaster, or the still more recent establishment of Infant Schools, in which so little is left to Nature's own tuition.

CHAP. IV.

OF PUBERTY.

It has been often said, that the season of youth is the season of pleasures: but this can only be true in savage countries, where but little preparation is made for the perfection of human nature; and where the mind has but a very small part in the enjoyment. It is otherwise in those places where nature is carried to the highest pitch of refinement, in which this season of the greatest sensual delight is wisely made subservient to the succeeding and more rational one of manhood. Youth with us is but a scene of preparation; a drama, upon the right conduct of which all future happiness is to depend. The youth who follows his appetites too soon seizes the cup, before it has received its best ingredients; and, by anticipating his pleasures, robs the remaining parts of life of their share; so that his eagerness only produces a manhood of imbecility, and an age of pain.

The time of puberty is different in various countries, and always more late in men than in women. In the warm countries of India, the women are marriageable at nine or ten, and the men at twelve or thirteen. It is also different in cities where the inhabitants lead a more soft, luxurious life, from the country, where they work harder, and fare less delicately. Its symptoms are seldom alike in different persons, but it is usually known by a swelling of the breasts in one sex, and a roughness of the voice in the other. At this season, also, the women seem to acquire new beauty, while the men lose all that delicate effeminacy of countenance which they had when boys.

All countries, in proportion as they are civilized or barbarous, improve or degrade the nuptial satisfaction. In those miserable regions, where strength makes the only law, the stronger sex exerts its power, and becomes the tyrant over the weaker: while the inhabitant of Negroland is indolently taking his pleasure in the fields, his wife is obliged to till the ground that serves for their mutual support. It is thus in all barbarous countries, where the men throw all the laborious duties of life upon the women; and, regardless of beauty, put the softer sex to those employments that must effectually destroy it.

But, in countries that are half barbarous, particularly wherever Mahometanism prevails, the men run into the very opposite extreme. Equally brutal with the former, they exert their tyranny over the weaker sex, and consider that half of the human creation as merely made to be subservient to the depraved desires of the other. The chief, and, indeed, the only aim of an Asiatic, is to be possessed of many women; and to be able to furnish a seraglio is the only tendency of his ambition. As the savage was totally regardless of beauty, he on the contrary prizes it too highly; he excludes the person who is possessed of such personal attractions from any share in the duties or employments of life; and, as if willing to engross all beauty to himself, increases the number of his captives in proportion to the progress of his fortune. In this manner he vainly expects to augment his satisfactions, by seeking from many that happiness which he ought to look for in the society of one alone. He lives a gloomy tyrant amidst wretches of his own making; he feels none of those endearments which spring from affection, none of those delicacies which arise from knowledge. His mistresses, being shut out from the world, and totally ignorant of all that passes there, have no arts to entertain his mind, or calm his anxieties; the day passes with them in sullen silence, or languid repose; appetite can furnish but few opportunities of varying the scene; and all that falls beyond it must be irksome expectation.

From this avarice of women, if I may be allowed to express it so, has proceeded that jealousy and suspicion which ever attends the miser: hence those low and barbarous methods of keeping the women of those countries guarded, and of making and procuring eunuchs to attend them. These unhappy creatures are of two kinds, the white and the black. The white are generally made in the country where they reside, being but partly deprived of the marks of virility; the black are generally brought from the interior parts of Africa, and are made entirely bare. These are chiefly chosen for their deformity; the thicker the lips, the flatter the nose, and the more black the teeth, the more valuable the eunuch; so that the vile jealousy of mankind here inverts the order of nature, and the poor wretch finds himself valued in proportion to his deficiencies. In Italy, where this barbarous custom is still retained, and eunuchs are made in order to improve the voice, the laws are severely aimed against such practice; so that being entirely prohibited, none but the poorest and most abandoned of the people, still secretly practise it upon their children. Of those served in this manner, not one in ten is found to become a singer; but such is the luxurious folly of the times, that the success of one amply compensates for the failure of the rest. It is very difficult to account for the alterations which castration makes in the voice, and the other parts of the body. The eunuch is shaped differently from others. His legs are of an equal thickness above and below; his knees weak; his shoulders narrow, and his beard thin and downy. In this manner his person is rendered more deformed; but his desires, I am told, still continue the same; and actually, in Asia, some of them are found to have their seraglios, as well as their masters. Even in our country, we have an instance of a very fine woman being married to one of them whose appearance was the most unpromising; and what is more extraordinary still, I am told, that this couple continue perfectly happy in each other's society.

The mere necessities of life seem the only aim of the savage; the sensual pleasures are the only study of the semi-barbarian; but the refinement of sensuality by reason, is the boast of real politeness. Among the merely barbarous nations, such as the natives of Madagascar, or the inhabitants of Congo, nothing is desired so ardently as to prostitute their wives or daughters to strangers, for the most trifling advantages: they will account it a dishonour not to be among the foremost who are thus received into favour: on the other hand, the Mahometan keeps his wife faithful, by confining her person; and would instantly put her to death, if he but suspected her chastity. With the politer inhabitants of Europe, both these barbarous extremes are avoided; the woman's person is left free, and no constraint is imposed but upon her affections. The passion of love, which may be considered as the nice conduct of ruder desire, is only known and practised in this part of the world; so that what other nations guard as their right, the more delicate European is contented to ask as a favour. In this manner the concurrence of mutual appetite contributes to increase mutual satisfaction; and the power on one side of refusing makes every blessing more grateful when obtained by the other. In barbarous countries woman is considered merely as a useful slave; in such as are somewhat more refined she is regarded as a desirable toy; in countries entirely polished she enjoys juster privileges, the wife being considered as a useful friend and an agreeable mistress. Her mind is still more prized than her person; and without the improvement of both, she can never expect to become truly agreeable; for her good sense alone can preserve what she has gained by her beauty.

Female beauty, as was said, is always seen to improve about the age of puberty: but if we should attempt to define in what this beauty consists, or what constitutes its perfection, we should find nothing more difficult to determine. Every country has its peculiar way of thinking, in this respect; and even the same country thinks differently at different times. The ancients had a different taste from what prevails at present. The eyebrows joining in the middle was considered as a very peculiar grace by Tibullus, in the enumeration of the charms of his mistress. Narrow foreheads were approved of, and scarce any of the Roman ladies, that are celebrated for their other perfections, but are also praised for the redness of their hair. The nose of the Grecian Venus, was such as would appear at present an actual deformity; as it fell in a straight line from the forehead without the smallest sinking between the eyes, without which we never see a face at present.

Among the moderns, every country seems to have peculiar ideas of beauty.[1] The Persians admire large eyebrows, joining in the middle; the edges and corners of the eyes are tinctured with black, and the size of the head is increased by a great variety of bandages, formed into a turban. In some parts of India black teeth and white hair are desired with ardour; and one of the principal employments of the women of Thibet, is to redden the teeth with herbs, and to make their hair white by a certain preparation. The passion for coloured teeth obtains also in China and Japan; where, to complete their idea of beauty, the object of desire must have little eyes, nearly closed, feet extremely small, and a waist far from being shapely. There are nations of the American Indians that flatten the heads of their children, by keeping them while young squeezed between two boards, so as to make the visage much larger than it would naturally be. Others flatten the head at the top; and others make it as round as they possibly can. The inhabitants along the western coasts of Africa have a very extraordinary taste for beauty. A flat nose, thick lips, and a jet black complexion, are there the most indulgent gifts of Nature. Such, indeed, they are all, in some degree, found to possess. However, they take care by art to increase their natural deformities, as they should seem to us; and they have many additional methods of rendering their persons still more frightfully pleasing. The whole body and visage is often scared with a variety of monstrous figures; which is not done without a great pain, and repeated incision: and even sometimes parts of the body are cut away. But it would be endless to remark the various arts which caprice or custom has employed to distort and disfigure the body, in order to render it more pleasing; in fact, every nation, how barbarous soever, seems satisfied with the human figure, as Nature has left it, and has its peculiar arts of heightening beauty.[1] Painting, powdering, cutting, boring the nose and the ears, lengthening the one and depressing the other, are arts practised in many countries; and, in some degree, admired in all. These arts might have been at first introduced to hide epidemic deformities: custom, by degrees, reconciles them to the view; till, from looking upon them with indifference, the eye at length begins to gaze with pleasure.

---

[1] Buffon.

CHAP. V

THE AGE OF MANHOOD.[2]

The human body attains to its full height during the age of puberty; or, at least, a short time after. Some young people are found to cease growing at fourteen or fifteen; others continue their growth till two or three and twenty. During this period they are all of a slender make; their thighs and legs small, and the muscular parts are yet unfilled. But by degrees the fleshy fibres augment; the muscles swell, and assume their figure; the limbs become proportioned, and rounder; and before the age of thirty, the body in men has acquired the most perfect symmetry. In women, the body arrives at perfection much sooner, as they arrive at the age of maturity more early; the muscles, and all the other parts, being weaker, less compact and solid, than those of man, they require less time in coming to perfection: and as they are less in size, that size is sooner completed. Hence the persons of women are found to be as complete at twenty, as those of men are found to be at thirty.

The body of a well shaped man ought to be square; the muscles should be expressed with boldness, and the lines of the face strongly marked. In the woman, all the muscles should be rounder, the lines softer, and the features more delicate. Strength and majesty belong to the man; grace and softness are the peculiar embellishments of the other sex. In both every part of their form declares their sovereignty over other creatures. Man supports his body erect; his attitude is that of command; and his face, which is turned towards the heavens, displays the dignity of his station. The image of his soul is painted in his visage; and the excellence of his nature penetrates through the material form in which it is inclosed. His majestic port, his sedate and resolute step, announce the nobleness of his rank. He touches the earth only with his extremity; and beholds it as if at a disdainful distance. His arms are not given him, as to other creatures, for pillars of support; nor does he lose, by rendering them callous against the ground, that delicacy of touch which furnishes him with so many of his enjoyments. His hands are made for very different purposes; to second every intention of his will, and to protect the gifts of Nature.

When the soul is at rest, all the features of the visage seem settled in a state of profound tranquillity. Their proportion, their union, and their harmony, seem to mark the sweet serenity of the mind, and give a true information of what passes within. But when the soul is excited, the human visage becomes a living picture; where the passions are expressed with as much delicacy as energy, where every motion is designed by some correspondent feature, where every impression anticipates the will, and betrays those hidden agitations, that he would often wish to conceal.

It is particularly in the eyes that the passions are painted; and in which we may most readily discover their beginning. The eye seems to belong to the soul more than any other organ; it seems to participate of all its emotions; as well the most soft and tender as the most tumultuous and forceful. It not only receives, but transmits them by sympathy; the observing eye of one catches the secret fire from another; and the passion thus often becomes general.

---

[1] The abominable custom of flattening their heads prevails among the Indians of North Western America. Immediately after birth the infant is placed in a kind of oblong cradle, formed like a trough, with moss under it. One end, on which the head reposes, is more elevated than the rest. A padding is then placed on the forehead, with a piece of cedar-bark over it, and by means of cords passed through small holes on each side of the cradle, the padding is pressed against the head. It is kept in this manner above a year, and is not, I believe, attended with much pain. The appearance of the infant, however, while in this state of compression, is frightful, and its little black eyes, forced out by the tightness of the bandages, resemble those of a mouse choked in a trap. When released from this inhuman process, the head is perfectly flattened, and the upper part of it seldom exceeds an inch in thickness. It never afterwards recovers its rotundity. They deem this an essential point of beauty, and the most devoted adherent of our first Charles never entertained a stronger aversion to a *Roundhead* than these savages.—*Ross Cox's Adventures on the Columbia River.*

The practices of savages have often a parallel in those of civilization. Half a century ago, it was the custom of nurses to bind infants so tightly round the body with swaddling-clothes, that the natural form of the chest was altered. Some young ladies still do the same with stays, deranging, by tight lacing, the whole animal functions, and inducing diseases of the stomach, spine, and lungs.

[2] This chapter is translated from Mr Buffon, whose description is very excellent. Whatever I have added is marked by inverted commas, "thus." And in whatever trifling points I have differed, the notes will serve to show.—*Note by Goldsmith.*

Such persons as are short-sighted, labour under a particular disadvantage in this respect. They are, in a manner, entirely cut off from the language of the eyes; and this gives an air of stupidity to the face, which often produces very unfavourable prepossessions. However intelligent we find such persons to be, we can scarcely be brought back from our first prejudice, and often continue in the first erroneous opinion. In this manner we are too much induced to judge of men by their physiognomy; and having perhaps, at first, caught up our judgments prematurely, they mechanically influence us all our lives after. This extends even to the very colour or the cut of people's clothes; and we should for this reason be careful, even in such trifling particulars, since they go to make up a part of the total judgment which those we converse with may form to our advantage.

The vivacity, or the languid motion of the eyes, give the strongest marks of physiognomy; and their colour contributes still more to enforce the expression. The different colours of the eye are the dark hazel, the light hazel, the green, the blue and gray, the whitish gray, "and also the red." These different colours arise from the different colours of the little muscles that serve to contract the pupil; "and they are very often found to change colour with disorder, and with age."

The most ordinary colours are the hazel and the blue, and very often both these colours are found in the eyes of the same person. Those eyes which are called black, are only of the dark hazel, which may be easily seen upon close inspection; however, those eyes are reckoned the most beautiful where the shade is deepest: and either in these, or the blue eyes, the fire which gives its finest expression to the eye is more distinguishable in proportion to the darkness of the tint. For this reason, the black eyes, as they are called, have the greatest vivacity; but probably the blue have the most powerful effect in beauty, as they reflect a greater variety of lights, being composed of more various colours.

This variety, which is found in the colour of the eyes is peculiar to man, and one or two other kinds of animals; but, in general, the colour in any one individual is the same in all the rest. The eyes of oxen are brown; those of sheep of a water colour; those of goats are gray: "and it may also be, in general, remarked that the eyes of most white animals are red; thus the rabbit, the ferret, and, even in the human race, the white Moor, all have their eyes of a red colour."

Although the eye, when put into motion, seems to be drawn on one side, yet it only moves round the centre; by which its coloured part moves nearer or farther from the angle of the eye-lids, or is elevated or depressed. The distance between the eye is less in man than in any other animal; and in some of them it is so great, that it is impossible that they should ever view the same object with both eyes at once, unless it be very far off. "This, however, in them is rather an advantage than an inconvenience, as they are thus able to watch round them, and guard against the dangers of their precarious situation."

Next to the eyes, the features, which most give a character to the face, are the eye-brows; which being, in some measure, more apparent than the other features, are most readily distinguished at a distance. "Le Brun, in giving a painter directions, with regard to the passions, places the principal expression of the face in the eye-brows." From their elevation or depression, most of the furious passions are characterized; and such as have this feature extremely movable, are usually known to have an expressive face. By means of these we can imitate all the other passions, as they are raised or depressed at command; the rest of the features are generally fixed; or, when put into motion, they do not obey the will: the mouth and eyes, in an actor, for instance, may, by being violently distorted, give a very different expression from what he would intend; but the eye-brows can scarcely be exerted improperly; their being raised denotes all those passions which pride or pleasure inspire; and their depression marks those which are the effects of contemplation and pain; and such who have this feature, therefore, most at command, are often found to excel as actors."

The eye-lashes have an effect, in giving expression to the eye, particularly when long and close: they soften its glances, and improve its sweetness. Man and apes are the only animals that have eye-lashes both upon the upper and lower lids; all other animals want them on the lid below.

The eye-lids serve to guard the ball of the eye, and to furnish it with a proper moisture. The upper lid rises and falls; the lower has scarcely any motion; and although their being moved depends on the will, yet it often happens that the will is unable to keep them open, when sleep, or fatigue, oppresses the mind. In birds and amphibious quadrupeds, the lower lid alone has motion; fishes and insects have no eye-lids whatsoever.

The forehead makes a large part of the face, and a part which chiefly contributes to its beauty. It ought to be justly proportioned; neither too round nor too flat; neither too narrow nor too low; and the hair should come thick upon its extremities. It is known to every body how much the hair tends to improve the face; and how much the being bald serves to take away from beauty.[1] The highest part of the head is that which becomes bald the soonest, as well as that part which lies immediately above the temples. The hair under the temples, and at the back of the head, is very seldom known to fail, “ and women are much less apt to become bald than men: Mr Buffon seems to think they never become bald at all; but we have too many instances of the contrary among us, not to contradict very easily the assertion. Of all parts or appendages of the body, the hair is that which is found most different, in different climates; and often not only contributes to mark the country, but also the disposition of the man. It is in general thickest where the constitution is strongest; and more glossy and beautiful, where the health is most permanent. The ancients held the hair to be a sort of excrement, produced like the nails; the part next the root pushing out that immediately contiguous.[2] But the moderns have found that every hair may be truly said to live, to receive nutriment, to fill and distend itself, like the other parts of the body. The roots, they observe, do not turn gray sooner than the extremities, but the whole hair changes colour at once; and we have many instances of persons who have grown gray in one night's time.[3] Each hair, if viewed with a microscope, is found to consist of five or six lesser ones, all wrapped up in one common covering; it appears knotted, like some sorts of grass, and sends forth branches at the joints. It is bulbous at the root, by which it imbibes its moisture from the body: and it is split at the points; so that a single hair, at its end, resembles a brush. Whatever be the size or the shape of the pore, through which the hair issues, it accommodates itself to the same; being either thick, as they are large; small, as they are less; round, triangular, and variously formed, as the pores happen to be various. The hair takes its colour from the juices flowing through it, and it is found that this colour differs in different tribes and races of people. The Americans, and the Asiatics, have their hair black, thick, straight, and shining. The inhabitants of the torrid climates of Africa have it black, short, and woolly. The people of Scandinavia have it red, long, and curled; and those of our own and the neighbouring countries, are found with hair of various colours. However, it is supposed by many, that every man resembles in his disposition the inhabitants of those countries whom he resembles in the colour and the nature of his hair: so that the black are said, like the Asiatics, to be grave and acute; the red, like the Gothic nations, to be choleric and bold. However this may be, the length and the strength of the hair is a general mark of a good constitution; and as that hair which is strongest is most commonly curled, so curled hair is generally regarded among us as a beauty.[1] The Greeks, however, had a very different idea of beauty in this respect; and seem to have taken one of their peculiar national distinctions from the length and the straightness of the hair."

---

[1] Since the hair, whether braided or dishevelled, adds so much to the character of the human figure, we need not wonder that peculiar fashions and customs respecting it have prevailed among all nations. The heathen priestesses, when under the influence of what they conceived inspiration, wore their hair dishevelled; for which reason St Paul forbade the Corinthian women, when at devotion, to wear it in this manner. Hence, in the earlier ages of Christianity, when its divine doctrines were struggling through the darkness, the clergy, both regular and secular, were obliged to have the crown of the head shaved, as a signal of self-denial and mortification. The popes, indeed, denounced long hair, and Anselm, the archbishop of Canterbury, pronounced the sentence of excommunication on those who were guilty of so heathenish a fashion. Serlo, a Norman bishop, acquired great honour for a sermon he preached before Henry I., in the year 1104, on this subject, which had such an effect on the king and his courtiers, that they immediately consented to cut away their flowing ringlets. The Jewish and Grecian women generally wore the hair long, and ornamented with gold, silver, and pearls. The Roman women dressed their hair in the form of a helmet, mixing false hair with it, which they contrived to fasten to the skin. They anointed it with rich perfumes, and, by the aid of curling irons, raised it to a great height by rows or stories of curls. They, too, adorned their hair with gold, pearls, and precious stones, sometimes with crowns or garlands, chaplets of flowers bound with fillets, or ribands of various colours. They used a certain plaster to pull off the small hairs from their cheeks, or plucked them up by the roots with tweezers, called *volsellae*. Among the ancient Gauls, long hair was esteemed an ornament: hence Julius Cæsar, having subdued them, made them, in token of submission, cut off their hair. Among the Anglo-Saxons and Danes, young women, before marriage, wore their hair uncovered and untied; but after marriage, they cut it short, tied it up, and wore head-dresses of various fashions. Amongst the Greeks, both sexes, a few days before marriage, cut off and consecrated their hair to some particular deity. It was customary also to hang the hair of the dead on the doors of their houses previous to interment. The ancients imagined that no person could die until a lock of hair had been cut away, an act supposed to be performed by the invisible hand of Isis, and consecrated to the god into whose realms the soul departed.

[2] Every individual hair may be regarded as a tube, which terminates in a root, or bulb. This root, or bulb, is situated below the skin, and consists of two coverings, an external and an internal. The external exhibits a vast number of blood vessels, which supply nourishment, and probably secrete the colouring matter of the hair. The internal is a simple membrane, within the other. It is hollow, and rises into the tube, which perforates the skin, and appears as the true hair externally. The tube arising from this bulb, is filled with a soft matter called the *medulla* or *pith*, of the hair, and contains numerous vessels. In passing from the root, or bulb, through the skin, it often raises up small scales of the cuticle, which soon become dry and fall off, as almost every person, in brushing the hair, must have observed. Every hair, therefore, consists of an outer sheath, which embraces the internal substance, or *pith*, in the same way as the finger of a glove covers the finger,—the end terminating below the skin in the bulb or root. This sheath, which we feel in touching the hair, consists of several very fine filaments, which are laid together longitudinally. They are of unequal lengths; and the centre one being the longest, every hair is pointed at the end. Besides this, when laid together, they are found to possess many small eminences; whence, if we draw a hair between our fingers, from the root to the end, it will feel smooth and even; but if we reverse it, and draw it from the point to the root, the hair will feel distinctly rough to the touch. For this reason, cloths made of wool irritate the skin; and wool is so difficult to spin, that these eminences require to be previously overcome by the aid of oil. On this structure of hair, the operation of felting depends, in which the hairs are pressed down in different directions, and become so interwoven, as to form a continuous mass. Such is the felt of which hats are made.

[3] Mr Buffon says, that the hair begins to grow gray at the points; but the fact is otherwise.—*Note by Goldsmith.*

"The nose is the most prominent feature in the face; but, as it has scarcely any motion, and that only in the strongest passions, it rather adds to the beauty than to the expression of the countenance. However, I am told, by the skilful in this branch of knowledge, that wide nostrils add a great deal to the bold and resolute air of the countenance; and where they are narrow, though it may constitute beauty, it seldom improves expression." The form of the nose, and its advanced position, are peculiar to the human visage alone. Other animals, for the most part, have nostrils, with a partition between them; but none of them have an elevated nose. Apes themselves have scarcely any thing else of this feature but the nostrils; the rest of the feature lying flat upon the visage, and scarcely higher than the cheek-bones. "Among all the tribes of savage men, also, the nose is very flat; and I have seen a Tartar who had scarcely any thing else but two holes through which to breathe."

The mouth and lips, next to the eyes, are found to have the greatest expression. The passions have great power over this part of the face; and the mouth marks its different degrees by its different forms. The organ of speech still more animates this part, and gives it more life than any other feature in the countenance. The ruby colour of the lips, and the white enamel of the teeth, give it such a superiority over every other feature, that it seems to make the principal object of our regards. In fact, the whole attention is fixed upon the lips of the speaker: however rapid his discourse, however various the subject, the mouth takes correspondent situations and deaf men have been often found to see the force of those reasonings which they could not hear, understanding every word as it was spoken.

"The under jaw in man possesses a great variety of motions; while the upper has been thought, by many, to be quite immovable.[2] However, that it moves in man, a very easy experiment will suffice to convince us. If we keep the head fixed, with any thing between our teeth, the edge of a table for instance, and then open our mouths, we shall find that both jaws recede from it at the same time; the upper jaw rises, the lower falls, and the table remains untouched between them. The upper jaw has motion as well as the under; and, what is remarkable, it has its proper muscles behind the head for thus raising and depressing it. Whenever, therefore, we eat, both jaws move at the same time, though very unequally; for the whole head moving with the upper jaw, of which it makes a part, its motions are thus less observable." In the human embryo, the under jaw is very much advanced before the upper. "In the adult, it hangs a good deal more backward; and those whose upper and under row of teeth are equally prominent, and strike directly against each other, are what the painters call underhung; and they consider this as a great defect in beauty.[3] The under jaw in a Chinese face falls greatly more backward than with us; and I am told the difference is half an inch, when the mouth is shut naturally." In instances of the most violent passion, the under jaw has often an involuntary quivering motion; and often also, a state of languor, produces another, which is that of yawning. "Every one knows how very sympathetic this kind of languid motion is; and that for one person to yawn, is sufficient to set all the rest of the company a-yawning. A ridiculous instance of this was commonly practised upon the famous M'Laurin, one of the professors at Edinburgh. He was very subject to have his jaw dislocated; so that when he opened his mouth wider than ordinary, or when he yawned, he could not shut it again. In the midst of his harangues, therefore, if any of his pupils began to be tired of his lecture, he had only to gape or yawn, and the professor instantly caught the sympathetic affection; so that he thus continued to stand speechless, with his mouth wide open, till his servant, from the next room, was called in to set his jaw again."[1]

---

[1] *Effect of the Atmosphere on Hair.*—"My own beard, which in Europe was soft, silky, and almost straight, began immediately after my arrival at Alexandria to curl, to grow crisp, strong, and coarse; and before I reached Es-Souan resembled hare hair to the touch, and was all disposed in ringlets about the chin. This is, no doubt, to be accounted for by the extreme dryness of the air, which, operating through several thousand years, has, in the interior, changed the hair of the negro into a kind of coarse wool."—*St. John's Travels.*

[2] Mr Buffon is of this opinion. He says that the upper jaw is immovable in all animals. However, the parrot is an obvious exception; and so is man himself, as shown above.—*Note by Goldsmith.*

[3] Mr Buffon says, that both jaws, in a perfect face, should be on a level: but this is denied by the best painters.—*Note by Goldsmith.*

When the mind reflects with regret upon some good unattained or lost, it feels an internal emotion, which acting upon the diaphragm, and that upon the lungs, produces a sigh; this, when the mind is strongly affected, is repeated; sorrow succeeds these first emotions, and tears are often seen to follow: sobbing is the sigh still more invigorated; and lamentation, or crying, proceeds from the continuance of the plaintive tone of the voice, which seems to implore pity.[2] "There is yet a silent agony, in which the mind appears to disdain all external help, and broods over its distresses with gloomy reserve. This is the most dangerous state of mind: accidents or friendship may lessen the louder kinds of grief; but all remedies for this, must be had from within; and there despair too often finds the most deadly enemy."

Laughter is a sound of the voice, interrupted and pursued for some continuance. The muscles of the belly, and the diaphragm, are employed in the slightest exertions; but those of the ribs are strongly agitated in the louder; and the head sometimes is thrown backward, in order to raise them with greater ease. The smile is often an indication of kindness and good will: it is also often found used as a mark of contempt and ridicule.

Blushing proceeds from different passions; being produced by shame, anger, pride, and joy. Paleness is often also the effect of anger; and almost ever attendant on fright and fear. These alterations in the colour of the countenance are entirely involuntary: all the other expressions of the passions are, in some small degree, under control; but blushing and paleness betray our secret purposes; and we might as well attempt to stop them, as the circulation of the blood, by which they are caused.

The whole head, as well as the features of the face, takes peculiar attitudes from its passions: it bends forward to express humility, shame, or sorrow; it is turned to one side, in languor or in pity; it is thrown with the chin forward, in arrogance and pride; erect in self-conceit and obstinacy: it is thrown backwards in astonishment; and combines its motions to the one side and the other, to express contempt, ridicule, anger, and resentment. "Painters, whose study leads to the contemplation of external forms, are much more adequate judges of these than any naturalist can be; and it is with these a general remark, that no one passion is regularly expressed on different countenances in the same manner; but that grief often sits upon the face like joy, and pride assumes the air of passion. It would be vain, therefore, in words, to express their general effect, since they are often as various as the countenances they sit upon; and in making this distinction nicely, lies all the skill of the physiognomist. In being able to distinguish what part of the face is marked by nature, and what by the mind; what part has been originally formed, and what is made by habit; constitutes this science, upon which the ancients so much valued themselves, and which we at present so little regard. Some, however, of the most acute men among us have paid great attention to this art; and by long practice, have been able to give some character of every person whose face they examined. Montaigne is well known to have disliked those men who shut one eye in looking upon any object; and Fielding asserts that he never knew a person with a steady glavering smile, but he found him a rogue. However, most of these observations, tending to a discovery of the mind by the face, are merely capricious; and nature has kindly hid our hearts from each other, to keep us in good humour with our fellow-creatures."

---

[1] Since the publication of this work, the editor has been credibly informed, that the professor had not the defect here mentioned.—*Note by Goldsmith.*

[2] When the imagination is strongly impressed with any object, when the vital functions are languid, the vital principle seems to forsake all the organs, to concentrate itself on those which partake most in the affection of the mind. When a lover, in the midst of an agreeable reverie, sighs deeply, and at intervals, a physiologist perceives in that expression of desire, nothing but a long and deep inspiration, which, by fully distending the lungs, enables the blood, collected in the right cavities of the heart, to flow readily into the left cavities of that organ. This deep inspiration, which is frequently accompanied by groans, becomes necessary, as the motions of respiration rendered progressively slower, are no longer sufficient to dilate the pulmonary tissue.

Sobbing differs from sighing, merely in this, that though the expiration is long, it is interrupted, that is, divided into distinct periods.

Yawning is effected in the same manner; it is the certain sign of ennui, a disagreeable affection, which, to use the expression of Brown, may be considered as debilitating or *asthenic.* The fatigued inspiratory muscles have some difficulty in dilating the chest, the contracted lungs are not easily penetrated by the blood which stagnates in the right cavities of the heart, and produces an uneasy sensation, which is put an end to, by a long and deep inspiration; the admission of a considerable quantity of air is facilitated by opening the mouth widely, by the separation of both jaws. One yawns at the approach of sleep, because the agents of inspiration, being gradually debilitated, require to be roused at intervals. One is, likewise, apt to yawn on waking, that the muscles of the chest may be set for respiration, which is always slower and deeper, during sleep. It is for the same reason, that most animals yawn on waking, that the muscles may be prepared for the contractions which the motions of respiration require.

While gaping lasts, the perception of sounds is less distinct, the air, as it enters the mouth, rushes along the eustachian tubes into the tympanum, and the membrane is acted upon in a different direction. The recollection of the relief attending the deep inspiration which constitutes gaping, the recollection of the grateful sensation which follows the oppression that was felt before, involuntarily lead us to repeat this act, whenever we see any one yawning.

Sneezing consists in a violent and forcible expiration, during which the air, expelled with considerable rapidity, strikes against the tortuous nasal passages and occasions a remarkable noise. The irritation of the pituitary membrane determines, by sympathy, this truly convulsive effort of the pectoral muscles, and particularly of the diaphragm.

Coughing bears a considerable resemblance to sneezing and differs from it, only in the shorter period of duration and the greater frequency of the expirations; and as in sneezing, the air sweeps along the surface of the pituitary membrane and clears it of the mucus which may be lying upon it, so the air, when we cough, carries along with it the mucus contained in the bronchiæ, in the trachea and which we spit up. The violent cough, at the beginning of a pulmonary catarrh, the sneezing which attends coryza, show that the functions of the animal economy are not directed by an intelligent principle, for such an archæus could not mistake, in such a manner, the means of putting a stop to the disease, and would not call forth actions which, instead of removing the irritation and inflammation already existing, can only aggravate them.

Laughing is but a succession of very short and very frequent expirations. In hiccup, the air is forcibly inspired, enters the larynx with difficulty, on account of the spasmodic constriction of the glottis; it is then expelled rapidly, and striking against the sides of that aperture, occasions the particular noise attending it.—*Richerand's Elements of Physiology.*

The parts of the head which give the least expression to the face, are the ears: and they are generally found hidden under the hair. These, which are immovable, and make so small an appearance in man, are very distinguishing features in quadrupeds. These serve in them as the principal marks of the passions; the ears discover their joys or their terrors, with tolerable precision; and denote all their internal agitations. The smallest ears in men, are said to be the most beautiful; but the largest are found to be the best for hearing. There are some savage nations who bore their ears, and so draw that part down, that the tips of the ears are seen to rest upon their shoulders.

The strange variety in the different customs of men appears still more extravagant in their manner of wearing their beards.[1] Some, and among others the Turks, cut the hair off their heads, and let their beards grow. The Europeans, on the contrary, shave their beard, and wear their hair. The negroes shave their heads in figures at one time, in stars at another, in the manner of friars; and still more commonly in alternate stripes; and their little boys are shaved in the same manner. The Talapoins, of Siam, shave the heads and the eye-brows of such children as are committed to their care. Every nation seems to have entertained different prejudices, at different times, in favour of one part or another of the beard. Some have admired the hair upon the cheeks on each side, as we see with some low-bred men among ourselves, who want to be fine. Some like the hair lower down; some choose it curled; and others like it straight. "Some have it cut into a peak; and others shave all but the whisker. This particular part of the beard was highly prized among the Spaniards; till of late, a man without whiskers was considered as unfit for company; and where nature had denied them, art took care to supply the deficiency. We are told of a Spanish general, who, when he borrowed a large sum of money from the Venetians, pawned his whisker, which he afterwards took proper care to release. Kingson assures us, that a considerable part of the religion of the Tartars consists in the management of their whiskers: and that they waged a long and bloody war with the Persians, declaring them infidels, merely because they would not give their whiskers the orthodox cut.—The kings of Persia carried the care of their beards to a ridiculous excess, when they chose to wear them matted with gold thread: and even the kings of France, of the first races, had them knotted and buttoned with gold. But of all nations, the [aboriginal] Americans take the greatest pains in cutting their hair, and plucking their beards. The under part of the beard, and all but the whisker, they take care to pluck up by the roots, so that many have supposed them to have no hair naturally growing on that part; and even Linnæus has fallen into that mistake. Their hair is also cut into bands; and no small care employed in adjusting the whisker. In fact we have a very wrong idea of savage finery; and are apt to suppose that, like the beasts of the forest, they rise and are dressed with a shake, but the reverse is true; for no birth-night beauty takes more time or pains in the adorning her person than they. I remember, when the Cherokee kings were over here, that I have waited for three hours during the time they were dressing. They never would venture to make their appearance till they had gone through the tedious ceremonies of the toilet: they had their boxes of oil and ochre, their fat and their perfumes, like the most effeminate beau, and generally took up four hours in dressing before they considered themselves as fit to be seen. We must not, therefore, consider a delicacy in point of dress, as a mark of refinement, since savages are much more difficult in this particular than the most fashionable or tawdry European. The more barbarous the people, the fonder of finery. In Europe, the lustre of jewels, and the splendour of the most brilliant colours, are generally given up to women, or to the weakest part of the other sex, who are willing to be contemptibly fine: but in Asia, these trifling fineries are eagerly sought after, by every condition of men, and as the proverb has it, we find the richest jewels in an Ethiop's ear. The passion for glittering ornaments is still

---

[1] The practice of shaving probably originated at first from its being found that the beard afforded too good a hold to an enemy in battle. This is the cause assigned for the origin of shaving among the Greeks, about the time of Alexander; and in most countries we find that the practice is first adopted by military men, and that men of pacific and learned pursuits retain their beards much later. The Greeks continued to shave until the time of Justinian in whose reign long beards became again fashionable, and remained in use until Constantinople was taken by the Turks. The Romans appear to have derived the custom of shaving from the inhabitants of Sicily, who were of Greek origin; for we find that a number of barbers were sent from thence to Rome, in the year 296 B. C.; and the refinement of shaving daily is said to have been first introduced by no less a person than Scipio Africanus. At the expiration of the republic, beards had become very rare; and historians mention the alarm in which some of the emperors lived lest their barbers should cut their throats. For the sake of concealing the scars on his face, the emperor Hadrian wore a beard, and this, of course, brought that appendage again into use; but the custom did not long survive him, although his two immediate successors wore beards in the character of philosophers. Among the Romans, shaving did not commence immediately on the appearance of the hair; the youth was suffered to acquire a small beard, and the operation of shaving was performed for the first time with a great deal of ceremony. Persons of quality had the operation performed for their sons by persons of greater quality than themselves; and this act rendered such persons the adoptive fathers to the children. The day was a festival: visits of ceremony were paid to the young men, who received presents from their friends; and the first growth of the beard was solemnly consecrated to some deity—usually to the household gods.

The ancient German nations shaved the beard, except that on the upper lip; and what is expressly stated of one tribe was probably true of the rest—that they allowed no young man to shave or cut his hair until he had killed an enemy in battle. The ancient Goths, Franks, Gauls, and Britons, also wore only mustaches, the hair of which they suffered to grow to a very inconvenient length. The Saxons wore long beards, but, at the introduction of Christianity, the laity began, by degrees, to imitate the clergy, who were shaven; they, however, still retained the hair on the upper lip. The Danes appear to have worn their beards. Sueno, the first Danish chief who invaded this country, was surnamed "Fork-beard." The Normans shaved their beards entirely, and looked upon the appendage with so much distaste, as an indication of misery and distress, that they were the great apostles of shaving wherever they came. Accordingly, they endeavoured to persuade or compel the English to shave the hair of their upper lips. The great majority yielded to the necessity of the case, but there were many who chose rather to leave the country than resign their whiskers. However, beards again had their day. In the fourteenth century they became again fashionable, and continued until the beginning of the seventeenth. At the latter date their dimensions had become much contracted, and they were soon after relinquished, the mustaches only being retained; and at the commencement of the last century the practice of shaving the whole face had become universal. In these latter changes the example of France was followed. In that country, Henry IV. was the last sovereign who wore a beard, and he had a tolerably fine one. He was succeeded by a beardless minor, in compliment to whom the courtiers shaved all their beards except the mustaches. The succession of another minor confirmed the custom, and ultimately the mustaches also disappeared. The Spaniards, more tardily influenced by French example, kept their beards until the French and English were beginning to relinquish even mustaches. Perhaps they would have kept the cherished appendage to this day, but a French prince (Philip V.)

---

mounted the Spanish throne with a shaved chin. The courtiers, with heavy hearts, imitated the prince; and the people, with still heavier hearts, imitated the courtiers. The popular feeling on the subject, however remains recorded in the proverb, "Since we have lost our beards we have lost our souls."

The comparative advantages and propriety of shaving, and of permitting the beard to grow, would be difficult to determine. On the side of beards, it has been argued that nature must have bestowed such an appendage for the purpose of being worn; and that, as Tertullian affirmed, it is "blasphemy against the face," to reject it altogether. It is certain also, that a well kept beard adds greatly to dignity of appearance, and finely sets off other parts of the countenance, and in particular gives great expression to the eyes. A comparison of bearded and beardless portraits is generally much to the advantage of the former. It is difficult to suppose that Leonardo da Vinci, or Cardinal Bembo, or Cranmer, or the Shah of Persia, would look so well without their beards; and in Turkey it is impossible to compare the men who have been shaven, and otherwise Europeanized, with the bearded civilians in their flowing robes, without feeling that the former are, to use an oriental simile, "plucked pigeons" in comparison. We have heard much of the dignified and stately appearance of the Turks, but such a comparison enables us to perceive that most of their dignity is in their beards and their dresses. Then we must also take into account the trouble of shaving, which made Seume, a German writer, say, in his 'Journal,'—"To-day I threw my powder-apparatus out of the window. When will come the blessed day when I shall send the shaving apparatus after it!"

On the other hand, it may be alleged that, as the beard has always been shaven wherever men became highly civilized, its growth must have been found incompatible with the convenience and refinements of such a state, and would be a serious incumbrance in many delicate acts. Besides, we find that, among all bearded nations, the beard has always been invested with peculiar sacredness, which preserves it from any kind of violation; and as it is the tendency of civilization to eradicate prejudices, this would suffer among the rest, and men would live in continual peril of the practical jokes and rough handling which so conspicuous an appendage would seem almost to invite. Then it may be questioned whether the care which the beard would require to keep it in a decent state, and to prevent it from becoming a receptacle for dust and other impurities, is not fully equal to any that shaving occasions. In point of mere appearance, also, it may be stated that, what the eyes lose by the absence of the beard, obtains a full compensation, except in old age, by the greater advantage with which the mouth appears, stronger among the absolute barbarians, who often exchange their whole stock of provisions, and whatever else they happen to be possessed of, with our seamen, for a glass-bead, or a looking-glass.

Although fashions have arisen in different countries from fancy and caprice, these, when they become general, deserve examination.[1] Mankind have always considered it as a matter of moment, and they will ever continue desirous of drawing the attention of each other, by such ornaments as mark the riches, the power, or courage of the wearer. The value of those shining stones, which have at all times been considered as precious ornaments, is entirely founded upon their scarceness or their brilliancy. It is the same likewise with respect to those shining metals, the weight of which is so little regarded, when spread over our clothes. These ornaments are rather designed to draw the attention of others, than to add to any enjoyments of our own; and few there are, that these ornaments will not serve to dazzle, and who can coolly distinguish between the metal and the man.

All things rare and brilliant will, therefore, ever continue to be fashionable, while men derive greater advantage from opulence than virtue; while the means of appearing considerable, are more easily acquired, than the title to be considered. The first impression we generally make, arises from our dress; and this varies, in conformity to our inclinations, and the manner in which we desire to be considered. The modest man, or he who would wish to be thought so, desires to show the simplicity of his mind by the plainness of his dress; the vain man, on the contrary, takes a pleasure in displaying his superiority, "and is willing to incur the spectator's dislike, so he does but excite his attention."

Another point of view which men have in dressing, is to increase the size of their figure; and to take up more room in the world than Nature seems to have allotted them. We desire to swell out our clothes by the stiffness of art, and raise our heels, while we add to the largeness of our heads. How bulky soever our dress may be, our vanities are still more bulky. The largeness of the doctor's wig arises from the same pride with the smallness of the beau's queue. Both want to have the size of their understanding measured by the size of their heads.

There are some modes that seem to have a more reasonable origin, which is to hide or to lessen the defects of nature. To take men all together, there are many more deformed and plain than beautiful and shapely. The former, as being the most numerous, give law to fashion; and their laws are generally such as are made in their own favour. The women begin to colour their cheeks with red, when the natural roses are faded; and the younger are obliged to submit, though not compelled by the same necessity. In all parts of the world, this custom prevails more or less; and powdering and frizzing the hair, though not so general, seems to have risen from a similar control.

But leaving the draperies of the human picture, let us return to the figure, unadorned by art. Man's head, whether considered externally or internally, is differently formed from that of all other animals, the monkey-kind only excepted, in which there is a striking similitude.—There are some differences, however, which we shall take notice of in another place. The bodies of all quadruped animals are covered with hair; but the head of man seems the part most adorned, and that more abundantly than in any other animal.

There is a very great variety in the teeth of all animals; some have them above and below; others have them in the under jaw only; in some they stand separate from each other; while in some they are continued and united. The palate of some fishes is nothing else but a bony plate studded with points, which perform the offices of teeth. All these substances, in every animal, derive their origin from the nerves; the substance of the nerves hardens by being exposed to the air; and the nerves that terminate in the mouth, being thus exposed, acquire a bony solidity. In this manner the teeth and nails are formed in man; and in this manner also, the beak, the hoofs, the horns, and the talons, of other animals, are found to be produced.

The neck supports the head, and unites it to the body. This part is much more considerable in the generality of quadrupeds, than in man. But fishes, and other animals that want lungs similar to ours, have no neck whatsoever. Birds, in general, have the neck longer than any other kind of animals; those of them which have short claws, have also short necks; those, on the contrary, that have them long, are found to have the neck in proportion.—"In men, there is a lump upon the wind-pipe, formed by the thyroid cartilage, which is not to be seen in women: an Arabian fable says, that this is a part of the original apple, that has stuck in the man's throat by the way, but that the woman swallowed her part of it down."

---

[1] By the force of habit, and by an unconscious association in the mind, of a dress and its wearer, fashion, even to those who are somewhat fastidious, generally appears graceful. To please her, the fine lady of one country almost feeds herself into an apoplexy; and the would-be beauty of another starves herself into 'the sister to a shade.' The Chinese females cripple their feet, and the Europeans torture their waist into the narrowest possible compass. In one age she induces the fair sex to cover their faces with patches; and in the next, to blush, if necessity compel them to apply one; alternately to cashier, as it were, their natural tresses, in favour of false locks set on wires, to make them stand at a distance from the head—to elevate their hair to an immoderate height—or to cultivate it into drooping ringlets over the ears.

The human breast is outwardly formed in a very different manner from that of other animals. It is larger in proportion to the size of the body; and none but man, and such animals as make use of their fore-feet as hands, such as monkeys, bats, and squirrels, and such quadrupeds as climb trees, are found to have those bones called the *clavicles*, or, as we usually term them, the *collar bones*.[1] The breasts in women are larger than in men; however, they seem formed in the same manner; and, sometimes, milk is found in the breasts of men, as well as in those of women. Among animals, there is a great variety in this part of the body. The teats of some, as in the ape and the elephant, are like those of men, being but two, and placed on each side of the breast. The teats of the bear amount to four. The sheep has but two, placed between the hinder legs. Other animals, such as the bitch and the sow, have them all along the belly; and, as they produce many young, they have a great many teats for their support. The form also of the teats varies in different animals; and in the same animal at different ages. The bosom, in females, seems to unite all our ideas of beauty, where the outline is continually changing, and the gradations are soft and regular.[2]

"The graceful fall of the shoulders, both in man and woman, constitute no small part of beauty. In apes, though otherwise made like us, the shoulders are high, and drawn up on each side towards the ears. In man they fall by a gentle declivity; and the more so, in proportion to the beauty of his form. In fact, being high-shouldered, is not without reason considered as a deformity, for we find very sickly persons are always so, and people when dying are ever seen with their shoulders drawn up in a surprising manner. The muscles that serve to raise the ribs, mostly rise near the shoulders; and the higher we raise the shoulders, we the more easily raise the ribs likewise. It happens, therefore, in the sickly and the dying, who do not breathe without labour, that to raise the ribs, they are obliged to call in the assistance of the shoulders; and thus their bodies assume, from habit, that form which they are so frequently obliged to assume. Women with child, also, are usually seen to be high-shouldered; for the weight of the inferior parts drawing down the ribs, they are obliged to use every effort to elevate them, and thus they raise their shoulders of course. During pregnancy, also, the shape, not only of the shoulders, but also of the breast, and even the features of the face, are greatly altered; for the whole upper fore-part of the body is covered with a broad thin skin, called the myoides; which being, at that time, drawn down, it also draws down with it the skin, and, consequently, the features of the face. By these means the visage takes a particular form; the lower eye-lids and the corners of the mouth, are drawn downwards; so that the eyes are enlarged, and the mouth lengthened, and women in these circumstances, are said by the mid-wives, to be "*all mouth and eyes*."

The arms of men but very little resemble the fore-feet of quadrupeds, and much less the wings of birds. The ape is the only animal that is possessed of hands and arms; but these are much more rudely fashioned, and with less exact proportion, than in men; "the thumb not being so well opposed to the rest of the fingers, in their hands, as in ours."

---

[1] Mr Buffon says, that none but monkeys have them, but this is an oversight.—*Note by Goldsmith.*

[2] "When the babe," says Darwin, "soon after it is born into this cold world, is applied to its mother's bosom, its sense of perceiving warmth is first agreeably affected; next its sense of smell is delighted with the odour of her milk; then its taste is gratified by the flavour of it; afterwards the appetites of hunger and of thirst afford pleasure by the possession of their objects, and by the subsequent digestion of the aliment; and lastly, the sense of touch is delighted by the softness and smoothness of the milky fountain, the source of such variety of happiness. All those various kinds of pleasure at length become associated with the form of the mother's breast; which the infant embraces with its hands, presses with its lips, and watches with its eyes; and thus acquires more accurate ideas of the form of its mother's bosom, than of the odour and flavour, or warmth, which it perceives by other senses. And hence at our maturer years, when any object of vision is represented to us, which by its waving or spiral lines bears any similitude to the form of the female bosom, whether it be found in a landscape, with soft gradations of rising and descending surface, or in the form of some antique vases, or in other works of the pencil or the chisel, we feel a general glow of delight, which seems to influence all our senses; and if the object be not too large, we experience an attraction to embrace it with our arms, and salute it with our lips, as we did in our early infancy the bosom of our mothers. And thus we find, according to the ingenious idea of Hogarth, that the waving lines of beauty were originally taken from the Temple of Venus.

"If the wide eye the wavy lawns explores,
The bending woodlands, or the winding shores,
Hills, whose green sides with soft protuberance rise,
Or the blue concave of the vaulted skies;—
Or scans with nicer gaze the pearly swell
Of spiral volutes round the twisted shell:
Or undulating sweep, whose graceful turns
Bound the smooth surface of Etrurian urns,
When on fine forms the waving lines impress'd
Give the nice curves, which swell the female breast;
The countless joys the tender mother pours,
Round the soft cradle of our infant hours,
In lively trains of unextinct delight
Rise in our bosoms, *recognized by sight;*
Fond Fancy's eye recalls the form divine,
And Taste sits smiling upon Beauty's shrine.

Darwin's Temple of Nature.

The form of the back is not much different in man from that of other quadruped animals, only that the reins are more muscular in him, and stronger. The buttock, however, in man, is different, from that of all other animals whatsoever. What goes by that name in other creatures, is only the upper part of the thigh; man being the only animal that supports himself perfectly erect, the largeness of this part is owing to the peculiarity of his position.

Man's feet, also, are different from those of all other animals, those even of apes not excepted. The foot of the ape is rather a kind of awkward hand; its toes, or rather fingers, are long, and that of the middle longest of all. This foot also wants the heel, as in man; the sole is narrower, and less adapted to maintain the equilibrium of the body, in walking, dancing, or running.

The nails are less in man than in any other animal. If they were much longer than the extremities of the fingers, they would rather be prejudicial than serviceable, and obstruct the management of the hand. Such savages as let them grow long make use of them in flaying animals, in tearing their flesh, and such like purposes; however, though their nails are considerably larger than ours, they are by no means to be compared to the hoofs or the claws of other animals. "They may sometimes be seen longer, indeed, than the claws of any animal whatsoever; as we learn that the nails of some of the learned men in China are longer than their fingers. But these want that solidity which might give force to their exertions, and could never, in a state of nature, have served them for annoyance or defence."

There is little known exactly with regard to the proportion of the human figure; and the beauty of the best statues is better conceived by observing than by measuring them. The statues of antiquity, which were at first copied after the human form, are now become the models of it; nor is there one man found whose person approaches to those inimitable performances that have thus, in one figure, united the perfections of many. It is sufficient to say, that from being at first models, they are now become originals; and are used to correct the deviations in that form from whence they were taken. I will not, however, pretend to give the proportions of the human body as taken from these, there being nothing more arbitrary, and which good painters themselves so much contemn. Some, for instance, who have studied after these, divide the body into ten times the length of the face; and others into eight. Some pretend to tell us, that there is a similitude of proportion in different parts of the body. Thus, that the hand is the length of the face; the thumb the length of the nose; the space between the eyes is the breadth of an eye; that the breadth of the thigh, at thickest, is double that of the thickest part of the leg, and treble the smallest; that the arms extended are as long as the figure is high; that the legs and thigh are half the length of the figure. All this, however, is extremely arbitrary; and the excellence of a shape or the beauty of a statue, results from the attitude and position of the whole, rather than any established measurements, begun without experience, and adopted by caprice. In general, it may be remarked, that the proportions alter in every age, and are obviously different in the two sexes. In women, the shoulders are narrower, and the neck proportionably longer, than in men. The hips also are considerably larger, and the thighs much shorter, than in men. These proportions, however, vary greatly at different ages. In infancy, the upper parts of the body are much larger than the lower; the legs and thighs do not constitute any thing like half the height of the whole figure; in proportion as the child increases in age, the inferior parts are found to lengthen; so that the body is not equally divided until it has acquired its full growth.

The size of men varies considerably. Men are said to be tall who are from five feet eight inches to six feet high. The middle stature is from five feet five to five feet eight: and those are said to be of small stature who fall under these measures. "However, it ought to be remarked, that the same person is always taller when he rises in the morning, than upon going to bed at night; and sometimes there is an inch difference; and I have seen more. Few persons are sensible of this remarkable variation; and I am told, it was first perceived in England by a recruiting officer. He often found that those men whom he had enlisted for soldiers, and answered to the appointed standard at one time, fell short of it when they came to be measured before the colonel at the head-quarters. This diminution in their size proceeded from the different times of the day, and the different states of the body, when they happened to be measured. If, as was said, they were measured in the morning, after the night's refreshment, they were found to be commonly half an inch, and very often a whole inch, taller than if measured after the fatigues of the day; if they were measured when fresh in the country, and before a long fatiguing march to the regiment, they were found to be an inch taller than when they arrived at their journey's end.

All this is now well known among those who recruit for the army, and the reason of this difference of stature is obvious. Between all the joints of the back-bone, which is composed of several pieces, there is a glutinous liquor deposited, which serves, like oil in a machine, to give the parts an easy play upon each other. This lubricating liquor, or synovia, as the anatomists call it, is poured in during the season of repose, and is consumed by exercise and employment; so that in a body, after hard labour, there is scarce any of it remaining; but all the joints grow stiff, and their motion becomes hard and painful. It is from hence, therefore, that the body diminishes in stature. For this moisture being drained away from between the numerous joints of the back-bone, they lie closer upon each other; and their whole length is thus very sensibly diminished; but sleep, by restoring the fluid again, swells the spaces between the joints, and the whole is extended to its former dimensions.

"As the human body is thus often found to differ from itself in size, so it is found to differ in its weight also; and the same person, without any apparent cause, is found to be heavier at one time than another. If, after having eaten a hearty dinner, or having drank hard, the person should find himself thus heavier, it would appear no way extraordinary; but the fact is, the body is very often found heavier some hours after eating a hearty meal than immediately succeeding it. If, for instance, a person, fatigued by a day's hard labour, should eat a plentiful supper, and then get himself weighed upon going to bed; after sleeping soundly, if he is again weighed, he will find himself considerably heavier than before; and this difference is often found to amount to a pound, or sometimes to a pound and a half. From whence this adventitious weight is derived is not easy to conceive; the body, during the whole night, appears rather plentifully perspiring than imbibing any fluid, rather losing than gaining moisture: however, we have no reason to doubt, but that either by the lungs, or perhaps by a peculiar set of pores, it is all this time inhaling a quantity of fluid, which thus increases the weight of the whole body, upon being weighed the next morning."[1]

Although the human body is externally more delicate than any of the quadruped kind, it is, notwithstanding, extremely muscular; and, perhaps, for its size, stronger than that of any other animal. If we should offer to compare the strength of the lion with that of man, we should consider that the claws of this animal give us a false idea of its power; we ascribe to its force what is only the effect of its arms. Those which man has received from Nature are not offensive; happy had art never furnished him with any more terrible than those which arm the paws of the lion.

But there is another manner[2] of comparing the strength of man with that of other animals; namely, by the weights which either can carry. We are assured that the porters of Constantinople carry burdens of nine hundred pounds weight. M. Desaguliers tells us of a man, who by distributing weights in such a manner as that every part of his body bore its share, he was thus able to raise a weight of two thousand pounds.[3] A horse, which is about seven times our bulk, would be thus able to raise a weight of fourteen thousand pounds, if its strength were in the same proportion.[1] "But the truth is, a horse will not carry upon its back above a weight of two or three hundred pounds; while a man of confessedly inferior strength is thus able to support two thousand. Whence comes this seeming superiority? The answer is obvious. Because the load upon the man's shoulders is placed to the greatest advantage; while, upon the horse's back, it is placed at the greatest disadvantage. Let us suppose for a moment the man standing as upright as possible, under the great load above mentioned. It is obvious that all the bones of his body may be compared to a pillar supporting a building, and that his muscles have scarce any share in this dangerous duty. However, they are not entirely inactive; as man, let him stand never so upright, will have some bending in different parts of his body. The muscles, therefore, give the bones some assistance, and that with the greatest possible advantage. In this manner, a man has been found to support two thousand weight; but may be capable of supporting a still greater. The manner in which this is done, is by strapping the load round the shoulders of the person who is to bear it, by a machine, something like that by which milk-vessels or water-buckets are carried. The load being thus placed on a scaffold, on each side, contrived for that purpose, and the man standing erect in the midst, all parts of the scaffold, except that where the man stands, are made to sink; and thus the man maintaining his position, the load, whatever it is, becomes suspended, and the column of his bones may be fairly said to support it. If, however, he should but ever so little give way, he must inevitably drop; and no power of his can raise the weights again. But the case is very different with regard to a load laid upon a horse. The column of the bones there lies a different way; and a weight of five hundred pounds, as I am told, would break the back of the strongest horse that could be found. The great force of a horse and other quadrupeds, is exerted when the load is in such a position as that the column of the bones can be properly applied, which is lengthwise. When, therefore, we are to estimate the comparative strength of a horse, we are not to try what he can carry, but what he can draw; and in this case, his amazing superiority over man is easily discerned; for one horse can draw a load that ten men cannot move. And in some cases it happens that a draught horse draws the better for being somewhat loaded; for, as the peasants say, the load upon the back keeps him better to the ground."

---

[1] From this experiment also, the learned may gather upon what a weak foundation the whole doctrine of Sanctorian perspiration is built: but this disquisition more properly belongs to medicine than natural history. —*Note by Goldsmith.*

[2] Mr Buffon calls it a better manner; but this is not the case.—*Note by Goldsmith.*

[3] Sir David Brewster, in his work on *Natural Magic*, gives some striking instances of muscular strength, and also of the effects produced by applying the principles of the mechanical powers to the human frame, from which we extract the following:—Firmus, a native of Seleucia, who was executed by the emperor Aurelian for espousing the cause of Zenobia, was celebrated for his feats of strength. In his account of the life of Firmus, who lived in the third century, Vopiscus informs us, that he could suffer iron to be forged upon an anvil placed upon his breast. In doing this, he lay upon his back, and resting his feet and shoulders against some support, his whole body formed an arch, as we shall afterwards more particularly explain. Until the end of the sixteenth century, the exhibition of such feats does not seem to have been common. About the year 1703, a native of Kent, of the name of Joyce, exhibited such feats of strength in London and other parts of England, that he received the name of the *second Samson*. His own personal strength was very great; but he had also discovered, without the aid of theory, various positions of the body, in which men even of common strength could perform very surprising feats. He drew against horses, and raised enormous weights; but as he actually exhibited his power in ways which evinced the enormous strength of his own muscles, all his feats were ascribed to the same cause. In the course of eight or ten years, however, his methods were discovered, and many individuals of ordinary strength exhibited a number of his principal performances, though in a manner greatly inferior to Joyce. Some time afterwards, John Charles van Eckeberg, a native of Harzegerode, in Anhalt, travelled through Europe, under the appellation of *Samson*, exhibiting very remarkable examples of his strength. This, we believe, is the same person whose feats are particularly described by doctor Desaguliers. He was a man of the middle size, and of ordinary strength; and, as doctor Desaguliers was convinced that his feats were exhibitions of skill, and not of strength, he was desirous of discovering his methods; and, with this view, he went to see him, accompanied by the marquis of Tullibardine, doctor Alexander Stuart, and doctor Pringle, and his own mechanical operator. They placed themselves round the German so as to be able to observe accurately all that he did; and their success was so great, that they were able to perform most of the feats the same evening by themselves, and almost all the rest when they had provided the proper apparatus. Doctor

---

[1] Mr Buffon carries this subject no farther; and thus far, without explanation, it is erroneous.—*Note by Goldsmith.*

Desaguliers exhibited some of the experiments before the royal society, and has given such a distinct explanation of the principles on which they depend, that we shall endeavour to give a popular account of them. 1. The performer sat upon an inclined board with his feet a little higher than his hips. His feet were placed against an upright board well secured. Round his loins was placed a strong girdle with an iron ring in front. To this ring a rope was fastened. The rope passed between his legs through a hole in the upright board, against which his feet were braced, and several men or two horses, pulling on the rope, were unable to draw him out of his place. 2. He also fastened a rope to a high post, and, having passed it through an iron eye fixed in the side of the post some feet lower down, secured it to his girdle. He then planted his feet against the post near the iron eye, with his legs contracted, and, suddenly stretching out his legs, broke the rope, and fell backwards on a feather bed. 3. In imitation of Firmus, he laid himself down on the ground, and when an anvil was placed upon his breast, a man hammered with all his force a piece of iron, with a sledge hammer, and sometimes two smiths cut in two with chisels a great cold bar of iron laid upon the anvil. At other times, a stone of huge dimensions was laid upon his belly, and broken with a blow of the great hammer. 4. The performer then placed his shoulders upon one chair, and his heels upon another, forming with his backbone, thighs, and legs, an arch. One or two men then stood upon his belly, rising up and down while the performer breathed. A stone one and a half feet long, one foot broad, and half a foot thick, was then laid upon his belly and broken by a sledge-hammer—an operation which was performed with much less danger than when his back touched the ground. 5. His next feat was to lie down on the ground. A man being then placed on his knees, he drew his heels towards his body, and, raising his knees, he lifted up the man gradually, till, having brought his knees perpendicularly under him, he raised his own body up, and, placing his arms around the man's legs, rose with him, and set him down on some low table or eminence of the same height as his knees. This feat he sometimes performed with two men in place of one. 6. In his last, and apparently most wonderful performance, he was elevated on a frame work, and supported a heavy cannon placed upon a scale at some distance below him, which was fixed to a rope attached to his girdle. Previous to the fixing of the scale to the rope attached to his girdle, the cannon and scale rested upon rollers; but when all was ready, the rollers were knocked away, and the cannon remained supported by the strength of his loins. These feats may be briefly explained thus:—The feats No. 1, 2, and 6, depend entirely on the natural strength of the bones of the pelvis, which form a double arch, which it would require an immense force to break, by any external pressure directed to the centre of the arch; and as the legs and thighs are capable of sustaining four or five thousand pounds when they stand quite upright, the performer has no difficulty in resisting the force of two horses, or in sustaining the weight of a cannon weighing two or three thousand pounds. The feat of the anvil is certainly a very surprising one. The difficulty, however, really consists in sustaining the anvil; for when this is done, the effect of the hammering is nothing. If the anvil were a thin piece of iron, or even two or three times heavier than the hammer, the performer would be killed by a few blows; but the blows are scarcely felt when the anvil is very heavy, for the more matter the anvil has, the greater is its enertia, and it is the less liable to be struck out of its place; for when it has received by the blow the whole momentum of the hammer, its velocity will be so much less than that of the hammer as its quantity of matter is greater. When the blow, indeed, is struck, the man feels less of the weight of the anvil than he did before, because, in the reaction of the stone, all the parts of it round about the hammer rise towards the blow. This property is illustrated by the well-known experiment of laying a stick with its ends upon two drinking glasses full of water, and striking the stick downwards in the middle with an iron bar. The stick will in this case be broken without breaking the glasses or spilling the water. But if the stick is struck upwards, as if to throw it up in the air, the glasses will break if the blow be strong, and if the blow is not very quick, the water will be spilt without breaking the glasses. When the performer supports a man upon his belly, he does it by means of the strong arch formed by his back-bone and the bones of his legs and thighs. If there were room for them, he would bear three or four, or, in their stead, a great stone, to be broken with one blow. A number of feats of real and extraordinary strength were exhibited about a century ago, in London, by Thomas Topham, who was five feet ten inches high, and about thirty-one years of age. He was entirely ignorant of any of the methods for making his strength appear more surprising; and he often performed by his own natural powers what he learned had been done by others by artificial means. A distressing example of this occurred in his attempt to imitate the feat of the German Samson by pulling against horses. Ignorant of the method which we have already described, he seated himself on the ground, with his feet against two stirrups, and by the weight of his body he succeeded in pulling against a single horse; but in attempting to pull against two horses, he was lifted out of his place, and one of his knees was shattered against the stirrups, so as to deprive him of most of the strength of one of his legs. The following are the feats of real strength which doctor Desaguliers saw him perform:—1. Having rubbed his fingers with coal ashes to keep them from slipping, he rolled up a very strong and large pewter plate. 2. Having laid seven or eight short and strong pieces of tobacco-pipe on the first and third finger, he broke them by the force of his middle finger. 3. He broke the bowl of a strong tobacco-pipe, placed between his first and third finger, by pressing his fingers together sideways. 4. Having thrust such another bowl under his garter, his legs being bent, he broke it to pieces by the tendons of his hams, without altering the bending of his leg. 5. He lifted with his teeth, and held in a horizontal position for a considerable time, a table six feet long, with half a hundred weight hanging at the end of it. The feet of the table rested against his knees. 6. Holding in his right hand an iron kitchen poker three feet long and three inches round, he struck upon his bare left arm, between the elbow and the wrist, till he bent the poker nearly to a right angle. 7. Taking a similar poker, and holding the ends of it in his hands, and the middle against the back of his neck, he brought both ends of it together before him; and he then pulled it almost straight again. This last feat was the most difficult, because the muscles which separate the arms horizontally from each other, are not so strong as those which bring them together.

There is still another way of estimating human strength, by the perseverance and agility of our motions. Men who are exercised in running, outstrip horses; or, at least, hold their speed for a longer continuance. In a journey, also, a man will walk down a horse,[2] and, after they have both continued to proceed for several days, the horse will be quite tired, and the man will be fresher, than in the beginning. The king's messengers of Ispahan, who are runners by profession, go thirty-six leagues in fourteen hours. Travellers assure us, that the Hottentots outstrip lions in the chase; and that the savages who hunt the elk, pursue with such speed, that they at last tire down and take it. We are told many very surprising things of the great swiftness of the savages, and of the long journeys they undertake on foot, through the most craggy mountains, where there are no paths to direct, nor houses to entertain them. They are said to perform a journey of twelve

---

8. He broke a rope about two inches in circumference, which was partly wound about a cylinder four inches in diameter, having fastened the other end of it to straps that went over his shoulder. 9. Doctor Desaguliers saw him lift a rolling stone of about 800 pounds weight with his hands only, standing in a frame above it, and taking hold of a frame fastened to it. Hence doctor Desaguliers gives the following relative view of the strengths of individuals.

Strength of the weakest men, . . .	125 lbs.
Strength of very strong men, . . .	400 —
Strength of Topham, ...	800 —
The weight of Topham was about . .	200 —

One of the most remarkable and inexplicable experiments relative to the strength of the human frame, is that in which a heavy man is raised with the greatest facility, when he is lifted up the instant that his own lungs and those of the persons who raise him are inflated with air. The heaviest person in the party lies down upon two chairs, his legs being supported by the one and his back by the other. Four persons, one at each leg, and one at each shoulder, then try to raise him; and they find his dead weight to be very great, from the difficulty they experience in supporting him. When he is replaced in the chair, each of the four persons takes hold of the body as before, and the person to be lifted gives two signals by clapping his hands. At the first signal, he himself and the four lifters begin to draw a long and full breath; and when the inhalation is completed, or the lungs filled, the second signal is given for raising the person from the chair. To his own surprise and that of his bearers, he rises with the greatest facility, as if he were no heavier than a feather. When one of the bearers performs his part ill, by making the inhalation out of time, the part of the body which he tries to raise is left, as it were, behind. Among the remarkable exhibitions of mechanical strength and dexterity, we may enumerate that of supporting pyramids of men. This exhibition is a very ancient one. It is described, though not very clearly, by the Roman poet Claudian; and it has derived some importance in modern times, in consequence of its having been performed in various parts of Great Britain by the celebrated traveller Belzoni, before he entered upon the more estimable career of an explorer of Egyptian antiquities. The simplest form of this feat consists in placing a number of men upon each other's shoulders, so that each row consists of a man fewer, till they form a pyramid terminating in a single person, upon whose head a boy is sometimes placed with his feet upwards.

[2] This has been often asserted, but the experiment has never been fairly made. "When it comes to be tried," says Professor Wilson, whose judgment in gymnastical feats of all kinds is greatly to be relied on, "we shall bet on the head of the horse."

hundred leagues in less than six weeks. "But notwithstanding what travellers report of this matter, I have been assured from many of our officers and soldiers who compared their own swiftness with that of the native Americans during the last war, that although the savages held out, and as the phrase is, had better bottoms, yet, for a spurt, the English men were more nimble and speedy."

Nevertheless, in general, civilized man is ignorant of his own powers; he is ignorant how much he loses by effeminacy; and what might be acquired by habit and exercise. Here and there, indeed, men are found among us of extraordinary strength; but that strength, for want of opportunity, is seldom called into exertion. "Among the ancients it was a quality of much greater use than at present; as in war the same man that had strength sufficient to carry the heaviest armour, had strength sufficient also to strike the most fatal blow. In this case, his strength was at once his protection and his power. We ought not to be surprised, therefore, when we hear of one man as terrible to an army, and irresistible in his career, as we find some generals represented in ancient history. But we may be very certain that this prowess was exaggerated by flattery, and exalted by terror. An age of ignorance is ever an age of wonder. At such times, mankind, having no just ideas of the human powers, are willing rather to represent what they wish, than what they know; and exalt human strength, to fill up the whole sphere of their limited conceptions. Great strength is an accidental thing; two or three in a country may possess it; and these may have a claim to heroism. But what may lead us to doubt of the veracity of these accounts is, that the heroes of antiquity are represented as the sons of heroes; their amazing strength is delivered down from father to son; and this we know to be contrary to the course of nature. Strength is not hereditary, although titles are: and I am very much induced to believe, that this great tribe of heroes, who are all represented as the descendants of heroes, are more obliged to their titles than to their strength, for their characters. With regard to the shining characters in Homer, they are all represented as princes, and as the sons of princes; while we are told of scarce any share of prowess in the meaner men of the army; who are only brought into the field for these to protect, or to slaughter. But nothing can be more unlikely than that those men, who are bred in the luxury of courts, should be strong; while the whole body of the people, who received a plainer and simpler education, should be comparatively weak. Nothing can be more contrary to the general laws of nature, than that all the sons of heroes should thus inherit not only the kingdoms, but the strength of their forefathers; and we may conclude, that they owe the greatest share of their imputed strength rather to the dignity of their stations than the force of their arms; and, like all fortunate princes, their flatterers happened to be believed. In later ages, indeed, we have some accounts of amazing strength, which we can have no reason to doubt of. But in these, nature is found to pursue her ordinary course; and we find their strength accidental. We find these strong men among the lowest of the people, and gradually rising into notice, as this superiority had more opportunity of being seen. Of this number was the Roman tribune, who went by the name of the second Achilles; who, with his own hand, is said to have killed, at different times, three hundred of the enemy; and when treacherously set upon, by twenty-five of his own countrymen, although then past his sixtieth year, killed fourteen of them before he was slain. Of this number was Milo, who, when he stood upright, could not be forced out of his place. Pliny also tells us of one Athanatus, who walked across the stage at Rome, loaded with a breastplate weighing five hundred pounds, and buskins of the same weight. But of all the prodigies of strength, of whom we have any accounts in Roman history, Maximin, the emperor, is to be reckoned the foremost. Whatever we are told relative to him is well attested; his character was too exalted not to be thoroughly known; and that very strength, for which he was celebrated, at last procured him no less reward than the empire of the world. Maximin was above nine feet in height, and the best proportioned man in the whole empire. He was by birth a Thracian; and, from being a simple herdsman, rose through the gradations of office, until he came to be emperor of Rome. The first opportunity that he had of exerting his strength, was in the presence of all the citizens, in the theatre, where he overthrew twelve of the strongest men in wrestling, and out-stript two of the fleetest horses in running, all in one day. He could draw a chariot loaden, that two strong horses could not move; he could break a horse's jaw with a blow of his fist, and its thigh with a kick. In war he was always foremost and invincible: happy had it been for him and his subjects, if, from being formidable to his enemies, he had not become still more so to his subjects; he reigned, for some time, with all the world his enemy; all mankind wishing him dead, yet none daring to strike the blow. As if fortune had resolved that through life he should continue unconquerable, he was killed at last by his own soldiers while he was sleeping. We have many other instances, in later ages, of very great strength, and not fewer of amazing swiftness; but these, merely corporeal perfections, are now considered as of small advantage, either in war or in peace. The invention of gunpowder has, in some measure, levelled all force to one standard: and has wrought a total change in martial education through all parts of the world. In peace also the invention of new machines every day, and the application of the strength of the lower animals to the purposes of life, have rendered human strength less valuable. The boast of corporeal force is, therefore, consigned to savage nations, where those arts not being introduced, it may still be needful; but in more polite countries, few will be proud of that strength which other animals can be taught to exert to as useful purposes as they.

"If we compare the largeness and thickness of our muscles with those of any other animal, we shall find that, in this respect, we have the advantage; and if strength, or swiftness depended upon the quantity of muscular flesh alone, I believe that, in this respect, we should be more active and powerful than any other. But this is not the case; a great deal more than the size of the muscles goes to constitute activity or force: and it is not he who has the thickest legs than can make the best use of them. Those therefore who have written elaborate treatises on muscular force, and have estimated the strength of animals by the thickness of their muscles, have been employed to very little purpose. It is in general observed, that thin and raw-boned men are always stronger and more powerful, than such as are seemingly more muscular; as in the former all the parts have better room for their exertions.[1]

Women want much of the strength of men; and in some countries the stronger sex have availed themselves of the superiority, in cruelly and tyrannically enslaving those who

---

[1] In order to render more complete the physiological history of man, upon which Goldsmith, in this and other chapters of his work, has so delightfully written, we shall here make a long but interesting extract from a lecture on the architecture of the human body, by professor Dewhurst. Let us philosophically examine (says the professor) the manner in which man is constructed, and we shall find that it is in perfect accordance with the most exact mechanical principles: investigating the heart and the blood vessels, through which the vital fluid circulates, it is proved to be a perfect hydraulic machine, the heart being a most powerful engine by which the blood is propelled to the extremest part of the body; the lungs constitute an inimitable pneumatic apparatus; the beautiful membranes and transparent humours of the eye, forming an admirable optical instrument; in the same manner are the ears constructed on the most accurate principles of acoustics.

What an animated being! how vigorous and powerful! what beautiful and complicated machinery forms the graceful column of man! it being composed of bones, articulations or joints, arteries, and veins, clothed with muscles and integuments; how duly balanced! how aptly contrived for his various movements! At the summit of this column the head appears, appointed to this high situation as containing the seat of sensation, the light of understanding, and the faculty of sight. In the cranium, or skull, is situated the brain, the *organ* of the immaterial principle. In the brain the mind takes up its residence: here she holds communication with all the material things around her; from the brain she issues her commands, through the agency of the nerves, and sensations are conveyed from all parts of the body to the brain. The brain being extremely tender and susceptible of injury, the slightest local impression disturbing its action, it was necessary that it should be well protected from external violence. The skull will frequently bear the most surprising degree of mechanical force applied to it without suffering any injury. It is composed of eight bones united by dovetailed lines or sutures; if it had consisted only of one bone, it could not have answered every purpose for the defence of the brain. The division of the cranium into so many bones enables it to grow much faster, and with greater facility.

In order to facilitate the various movements of the head backward and forward, and in the act of nodding, looking upward and downward, it moves as an articulated fulcrum or prop, on which it can turn either backward or forward, up or down, horizontally to the right or to the left. The two first movements are effected by a hinge-joint fitted to the *atlas*, or first bone of the neck, but limited by ligaments, in its movements backward and forward, to prevent suffocation. The horizontal motion is effected by a peculiar auxiliary, placed on the bone below the first vertebra. It is a process of bone resembling a tooth, which fits into a pivot of the bone above it, and serves as an axle for the head to turn, but only to a limited extent, the muscles on each side protecting it from danger.

The spine, in figure, resembles, in some degree, an Italic *s*, and consists of twenty-four vertebræ, or bones, joined together by smooth-rubbing surfaces, and connected to each other by very strong intervening cartilages, more correctly termed intervertebral substance, which is extremely pliable, allowing great motion to the bones, and preventing their separation from one another, which would be followed by a material injury to the spinal marrow, and consequently to the destruction of life. The spine is the centre pillar on the top of which the head is situated; its use is to contain a prolongation of the brain, called the *spinal marrow*, which is of the greatest importance to animal life: if it is injured in the slightest degree, immediate death, or a paralysis of the parts below the injured portion, are the consequences. Consequently, in unison with all the works of the Creator, we find the spine uniting with great strength great elasticity and flexibility. The spine is susceptible of the greatest variety of motion; if it had only consisted of one bone, no motion could have taken place, and the spinal marrow would have been rendered more liable to injury. Those horrible distortions of the spine so often seen in highly civilized circles, are the effects of a disease of the intervertebral substance between the bones of the spine, created by that disgraceful system of tight-lacing the stays by fashionable females.

From the spinal marrow, the nerves supplying some of the principal organs in the chest, abdomen, and inferior extremities, receive their origin. The spine affords support to all the muscles of the trunk; the ribs are articulated into the vertebræ of the back.

There are twenty-four bones in the human spine, joined to each other by broad bases; in some parts these bases are shallower than in others, according as they are to serve more immediately either the purposes of flexibility or strength. In the back, where strength is most wanted, they are firmer than in the loins, where flexiwere made with equal pretensions to a share in all the advantages life can bestow. Savage nations oblige their women to a life of continual labour; upon them rest all the drudgeries of domestic duty, while the husband, reclined in his hammock, is first served from the fruits of her industry. From this negligent situation he is seldom roused, except by

---

bility is necessary; and still firmer in the neck, where the erect posture is chiefly required. Each of these bones is perforated through the middle, and so placed over and under those next to it, as to form a close canal for the medullary substance. To prevent this passage from being disturbed on change of posture, by the vertebræ shifting over one another, these bones are supplied with cartilages, which, being of an elastic and yielding nature, allow of those motions without separation of the bones themselves.

On the various joints of the bones much of their different effects depend. Each is mechanical, and resolvable by human reason. There are two principal sorts of joints; *viz. ball and socket*, and the *hinge-joint;* one or the other is used according to the extent of motion required. At the knee (the most complicated in structure) a hinge answers the purpose of moving the leg backwards and forwards, at the hip, a ball and socket serve to cooperate with the motion of the leg, and to move the limb to the right or left in any required position. The shoulder-joint is a ball and socket; but the socket here is very shallow, with a cartilage round its margin, while the cup of the thigh bone is very concave, and formed of more solid materials. These differences agree with the situations of each of them, and the purposes they are separately to answer; for as the one is a principal instrument of motion, the shallowness of the socket, and the flexibility of the cartilage, form its motion; while in the thigh and leg, which are to support the body, firmness is likewise necessary, which has been conceived in the conformation of the joints connected with them. In all the joints of the body, the ends of the bones are covered with cartilage, to prevent injury by the friction of hard substances. The ball, or head of the thigh bone, is tipped, and the cup lined, with this yielding substance; and the hip joint is protected by it. Each joint is supplied with a fluid denominated by anatomists *synovia*, by butchers, *joint oil*, which prevents the dreadful effects of friction.

The muscles and their tendons are not only constitutionally endowed to generate and regulate motion, but also differently constructed for these purposes, according to the movement required and the instruments used. For example, at the knee and elbow, where the joint is large, which serves only to move the limb in the same plane, the tendons are placed parallel to them, and lengthen or shorten in that direction; but in the hip and shoulder, where the ball and socket joint is found, the muscles are variously placed, and are capable of contracting and restoring themselves in each position. The muscles also, by their different directions, support the bones, particularly the head; and all the limbs are regulated in their movements chiefly by their agency. Each muscle has what is called an antagonist muscle; viz. one that acts in a direction contrary to the other: for the muscles cannot expand beyond their natural size, though they cannot contract; therefore, to produce a contrary motion, another muscle must be called into action: it is by this contrary motion of the muscles of the face, that the features are duly balanced in their places. The natural strength of the muscles may be either increased or diminished by exercise; for we perceive the legs of a dancing-master, the arms of a pugilist, waterman, or anchor-smith, are stronger by use. All the limbs of the body are levers of the third class; for the resistance must be farther from the prop than the power, the power being in the joint itself.

Muscles in general are pairs (with one or two exceptions we find them single, as the circular muscle of the mouth, &c); their number has been estimated at two hundred and eighty nine; but as they are the same on both sides, this must be doubled, which makes five hundred and seventy-eight, an enumeration which is pretty nearly correct. All animal motion is effected by muscles. They are divided into two great classes, viz. the *voluntary* and *involuntary;* those under the influence of the *will*, as the muscles of the arm and leg, &c.; and those whose action is independent of the will, as the *heart*, &c., which is merely a hollow muscle for the purpose of receiving the blood, and propelling it by means of arteries to all parts of the body. Each muscle has an antagonist muscle; viz. one that acts in a direction contrary to the other: one muscle throws the arm out, which is called the extensor: the other bends the arm, and is called the flexor; one muscle relaxes, while the other contracts. Nothing is satisfactorily known about muscular contraction; this physiological question is not decided. The muscles are supplied with nervous energy by means of white cords, called nerves, which arise from the brain and spinal marrow; we know nothing of the nature of this principle circulating in nerves; we can only witness its effects. That nervous energy is necessary to the healthy performance of the various functions of the body, there can be no doubt. Digestion, secretion, sight, hearing, smelling, tasting, &c. cannot be effected if the nerve of communication between their respective functions and the brain be divided.

The body is supported by the blood, which is circulated by means of tubes denominated arteries and veins, the former carrying it from, and the latter returning it to, the heart, which organ gives a motion to the arteries, synchronous with the heart itself, and extending to the extremest ramification in the body; this motion we denominate the pulse. Thus is man a complete piece of machinery, the whole of which is put into action by means of a power derived from the brain through the agency of its nerves. The vital fluid passes from the heart into the lungs in a state dangerous to the preservation of life, being loaded with carbon, which it gives off in those organs; on receiving a due proportion of oxygen from the atmosphere, the blood becomes purified and fit for the support of animal life. It circulates from the heart of a bright scarlet colour, and returns again to this organ of a reddish black, united with a great quantity of carbon, which it has obtained in the course of its circulation, after it has performed the trifold offices of *secretion*, *nutrition*, and *vivification* or the *preservation of life;* while the digestive organs perform their due offices, create the various secretions, and form new blood in lieu of that which is expended.

The blood in an adult human body has been estimated to circulate, throughout the whole system in four hours, or about six times in the course of a single day. Its quantity has been estimated by Bartholine to be about twenty-four pounds, and Sir Charles Bell considers thirty-three pounds as the average proportion, but in my opinion its exact quantity can never be truly ascertained.

By means of this beautiful mechanism of the heart and lungs is the important function of the circulation of the blood accomplished; and there is no portion of physiological research which displays greater perfection of design, a more admirable and splendid contrivance, or more ingenious machinery, than is exhibited in the formation of the heart and its vessels. The exquisite construction of even the most minute organ, and the harmonious sympathy pervading the whole, are objects of wonder, and must ever excite the veneration and admirathe calls of appetite, when it is necessary, either by fishing or hunting, to make a variety in his entertainments. A savage has no idea of taking pleasure in exercise; he is surprised to see a European walk forward for his amusement, and then return back again. As for his part, he could be contented to remain for ever in the same situation, perfectly satisfied with sensual pleasures and undisturbed repose. The women of these countries are the greatest slaves upon earth: sensible of their weakness, and unable to resist, they are obliged to suffer those hardships which are naturally inflicted by such as have been taught that nothing but corporeal force ought to give pre-eminence. It is not, therefore, till after some degree of refinement, that women are treated with lenity; and not till the highest degree of politeness, that they are permitted to share in all the privileges of man. The first impulse of savage nature is to confirm their slavery; the next of half barbarous nations, is to appropriate their beauty; and that of the perfectly polite, to engage their affections. In civilized countries, therefore, women have united the force of modesty to the power of their natural charms; and thus obtain that superiority over the mind, which they are unable to extort by their strength.

CHAP. VI.

OF SLEEP AND HUNGER.

As man, in all the privileges he enjoys, and the powers he is invested with, has a superiority over all other animals, so in his necessities, he seems inferior to the meanest of them all. Nature has brought him into life with a greater variety of wants and infirmities than the rest of her creatures, unarmed in the midst of enemies. The lion has natural arms; the bear natural clothing; but man is destitute of all such advantages; and from the superiority of his mind alone, he is to supply the deficiency. The number of his wants, however, were merely given, in order to multiply the number of his enjoyments; since the possibility of being deprived of any good, teaches him the value of its possession. Were men born with those advantages which he learns to possess by industry, he would very probably enjoy them with a blunter relish; it is by being naked that he knows the value of a covering; it is by being exposed to the weather, that he learns the comforts of a habitation. Every want thus becomes a means of pleasure, in the redressing; and the animal that has most desires, may be said to be capable of the greatest variety of happiness.

Besides the thousand imaginary wants peculiar to man, there are two, which he has in common with all other animals; and which he feels in a more necessary manner than they. These are the wants of sleep and hunger. Every animal that we are acquainted with, seems to endure the want of these with much less injury to health than man; and some are most surprisingly patient in sustaining both. The little domestic animals that we keep about us, may often set a lesson of calm resignation, in supporting want and watchfulness, to the boasted philosopher. They receive their pittance at uncertain intervals and wait its coming with cheerful expectation. We have instances of the dog and the cat living in this manner, without food, for several days; and yet still preserving their attachment to the tyrant that oppresses them; still ready to exert their little services for his amusement or defence. But the patience of these is nothing to what the animals of the forest endure. As these mostly live upon accidental carnage, so they are often known to remain without food for several weeks together. Nature, kindly solicitous for their support, has also contracted their stomachs, to suit them for their precarious way of living: and kindly, while it abridges the banquet, lessens the necessity of providing for it.

But the meaner tribes of animals are made still more capable of sustaining life without food, many of them remaining in a state of torpid indifference, till their prey approaches, when they jump upon and seize it. In this manner, the snake, or the spider, continue, for several months together, to subsist upon a single meal; and some of the butterfly kinds

---

tion of all who delight to search after and contemplate the more elaborate works and unerring operations of the great Author of Nature.

The blood is carried from the heart by means of tubes called arteries, and circulated by these through all parts of the body, and conveyed back again to the heart by veins. The nutritious portions of the various kinds of food we daily swallow are converted into blood. After masticating our food, it mixes with the saliva of the mouth, and is conveyed in a pulpy state to the stomach; it is there acted upon by a juice secreted by glands within the coats of the stomach, called *gastric* juice, which converts the food into *chyle*: it then passes from the stomach in this state into the large intestine, called the *duodenum*, where the nutritive part becomes separated from the feculent, and is converted into *chyle*, a substance resembling milk, which enters into a large vessel, called the *thoracic duct*, and passes upwards to its termination in a large vein near the neck, where it is converted into blood. This blood is not adapted for the nourishment of the body without passing through the lungs, where it is acted upon by the oxygen of the atmosphere, and becomes oxygenated, converted into *arterial blood*, in which state it nourishes the human body.

live upon little or nothing. But it is very different with man: his wants daily make their importunate demands; and it is known that he cannot continue to live many days without eating, drinking, and sleeping.

Hunger is a much more powerful enemy to man than watchfulness, and kills him much sooner. It may be considered as a disorder that food removes; and that would quickly be fatal without its proper antidote. In fact, it is so terrible to man, that to avoid it he even encounters certain death; and, rather than endure its tortures, he exchanges them for immediate destruction. However, by what I have been told, it is much more dreadful in its approaches, than in its continuance; and the pains of a famished wretch decrease, as his strength diminishes. In the beginning the desire of food is dreadful indeed, as we know by experience, for there are few who have not, in some degree, felt its approaches. But, after the first or second day, its tortures become less terrible, and a total insensibility at length comes kindly in to the poor wretch's assistance. I have talked with the captain of a ship, who was one of six that endured it in its extremities; and who was the only person that had not lost his senses, when they received accidental relief. He assured me, his pains at first were so great, as to be often tempted to eat a part of one of the men who died; and which the rest of his crew actually for some time lived upon: he said that during the continuance of this paroxysm, he found his pains insupportable; and was desirous, at one time, of anticipating that death which he thought inevitable: but his pains, he said, gradually decreased, after the sixth day, (for they had water in the ship, which kept them alive so long,) and then he was in a state rather of languor than desire; nor did he much wish for food, except when he saw others eating; and that for a while revived his appetite, though with diminished importunity. The latter part of the time, when his health was almost destroyed, a thousand strange images rose upon his mind; and every one of his senses began to bring him wrong information. The most fragrant perfumes appeared to him to have a fœtid smell; and every thing he looked at took a greenish hue, and sometimes a yellow. When he was presented with food by the ship's company that took him and his men up, four of whom died shortly after, he could not help looking upon it with lothing instead of desire; and it was not till after four days, that his stomach was brought to its natural tone, when the violence of his appetite returned, with a sort of canine eagerness.

Thus dreadful are the effects of hunger; and yet when we come to assign the cause that produces them, we find the subject involved in doubt and intricacy. This longing eagerness is, no doubt, given for a very obvious purpose; that of replenishing the body, wasted by fatigue and perspiration. Were not men stimulated by such a pressing monitor, they might be apt to pursue other amusements, with a perseverance beyond their power; and forget the useful hours of refreshment, in those more tempting ones of pleasure. But hunger makes a demand that will not be refused; and, indeed, the generality of mankind seldom await the call.

Hunger has been supposed by some to arise from the rubbing of the coats of the stomach against each other, without having any intervening substance to prevent their painful attrition.[1] Others have imagined that its juices,

---

[1] The proximate cause of hunger has by some, as stated in the text, been conceived to depend on the friction of the nervous papillæ of the empty stomach on each other; by others, it has been imputed to the irritation produced on its parietes, by the accumulation of the gastric juice. It has been thought to depend on the lassitude attending the permanent contraction of the muscular fibres of the stomach; and on the compression and creasing of the nerves, during that permament constriction; on the dragging down of the diaphragm by the liver and spleen, when the stomach and intestines being empty, cease to support those viscera: a dragging which is the greater, as a new mode of circulation takes place in the viscera, which are supplied with blood by the cæliac artery, and while the stomach receives less blood, the spleen and liver increase in weight and size, because their supply is increased.

Those who maintain, that hunger depends on the friction of the parietes of the stomach against each other, when brought together in an empty state, adduce the example of serpents, whose stomach is purely membranous, and who endure hunger a long time, while fowls, whose powerful and muscular stomach is able to contract strongly on itself, endure it with difficulty. But to say nothing of the great difference of vitality, in the organs of a bird and of a reptile, the stomach which continues closing on itself as it is emptied, may contract to such a degree as scarcely to equal in size a small intestine, without its following, as a necessary consequence, that the parietes which are in contact should exert on each other any friction, on which the sensation of hunger may depend. In fact, the presence of food is necessary to determine an action of the parietes of the stomach, and as long as it is empty, there is nothing to call forth such action.

Those who think that hunger is mechanically produced by the weight of the spleen and liver that keeps pulling down the diaphragm, which the empty stomach no longer bears up, observe, that it may be appeased, for a time, by supporting the abdominal viscera by means of a wide girdle; that hunger ceases as soon as the stomach is full, before the food can have yielded to it any materials of nutrition. On this hypothesis, which is purely mechanical, as that which explains hunger by the irritation of the gastric juice, by the lassitude of the contracted muscles, by the compression of the nerves, how shall we explain the fact, that when the hour of a meal is over, hunger ceases for a time? Ought not hunger, on the contrary, to be considered as a nervous sensation which exists in the stomach, is communicated by sympathy to all the other parts, and keeping up an active and continuous excitement in the organ in which it is principally seated, determines into it the fluids from wanting their necessary supply, turn acrid, or, as some say, pungent; and thus fret its internal coats, so as to produce a train of the most uneasy sensations. Boerhaave, who established his reputation in physic, by uniting the conjectures of all those that preceded him, ascribes hunger to the united effect of both these causes; and asserts, that the pungency of the gastric juices, and the attrition of its coats against each other, cause those pains, which nothing but food can remove. These juices continuing still to be separated in the stomach, and every moment becoming more acrid, mix with the blood, and infect the circulation: the circulation being thus contaminated, becomes weaker, and more contracted; and the whole nervous frame sympathizing, a hectic fever, and sometimes madness, is produced; in which state the faint wretch expires. In this manner, the man who dies of hunger may be said to be poisoned by the juices of his own body; and is destroyed less by the want of nourishment, than by the vitiated qualities of that which he had already taken.

However this may be, we have but few instances of men dying, except at sea, of absolute hunger. The decline of those unhappy creatures who are destitute of food, at land, being more slow and unperceived. These, from often being in need, and as often receiving an accidental supply, pass their lives between surfeiting and repining; and their constitution is impaired by insensible degrees. Man is unfit for a state of precarious expectation. That share of provident precaution which incites him to lay up stores for a distant day becomes his torment, when totally unprovided against an immediate call. The lower race of animals, when satisfied, for the instant moment, are perfectly happy: but it is otherwise with man; his mind anticipates distress, and feels the pangs of want even before it arrests him. Thus the mind, being continually harassed by the situation, it at length influences the constitution, and unfits it for all its functions. Some cruel disorder, but no way like hunger, seizes the unhappy sufferer; so that almost all those men who have thus long lived by chance, and whose every day may be considered as a happy escape from famine, are known at last to die in reality of a disorder caused by hunger; but which, in the common language, is often called a *broken heart*. Some of these I have known myself, when very little able to relieve them: and I have been told by a very active and worthy magistrate, that the number of such as die in London from want, is much greater than one would imagine—I think he talked of two thousand in a year!

But how numerous soever those who die of hunger may be, many times greater, on the other hand, are the number of those who die

---

all parts. This phenomenon, like all those which depend on nervous influence, is governed by the laws of habit, by the influence of sleep, and of the passions of the mind, whose power is so great, that literary men, absorbed in meditation and thought, have been known entirely to forget that they required food. Every thing which awakens the sensibility of the stomach, in a direct or sympathetic manner, increases the appetite and occasions hunger. Thus, bulimia depends, sometimes, on the irritation of a tape-worm in the organs of digestion. The application of cold to the skin, by increasing, from sympathy, the action of the stomach, has been known to occasion *fames canina*, of which several instances are related by Plutarch (Life of Brutus.) Ardent spirits, and highly seasoned food, excite the appetite, even when the stomach is overfilled. Whatever, on the contrary, blunts or renders less acute the sensibility of the stomach, renders more endurable or suspends the sensation of hunger. Thus, we are told by travellers, that the Turkish dervises and the Indian faquirs, endure long fasts, because they are in the habit of using opium, and lull, in a manner, by this narcotic, the sensibility of the stomach. Tepid and relaxing drinks impair the appetite; the use of opiates suspends suddenly the action of the stomach.

The calls of thirst are still more absolute than those of hunger, and it is much less patiently endured. If it be not satisfied, the blood, and the fluids which are formed from it, become more and more stimulating, from the concentration of the saline and other substances which they contain. The general irritation gives rise to an acute fever, with heat and parching of the fauces, which inflame and may even become gangrenous, as happens in some cases of hydrophobia. English sailors, who were becalmed, had exhausted all their stock of fresh water, and were at a distance from land; not a drop of rain had for a long while cooled the atmosphere: after having borne, for some time, the agonies of thirst, further increased by the use of salt provisions, they resolved to drink their own urine. This fluid, though very disgusting, allayed their thirst; but at the end of a few days, it became so thick and acrid, that they were incapable of swallowing a mouthful of it. Reduced to despair, they expected a speedy death, when they fell in with a ship which restored them to hope and life. Thirst is increased every time that the aqueous secretions are increased; thus, it becomes distressing to a dropsical patient, in whom the fluids are determined towards the seat of effusion. It is excessive in diabetes, and in proportion to the increased quantity of urine. In fever, it is increased, from the effect of perspiration, or because in some of these affections; for example, in bilious fevers, the blood seems to become more acrid. Hence the advantage of cooling, diluting, and refreshing drinks, administered copiously, with a view to correct the temporary acrimony occasioned by the absence of a great quantity of the serous parts of the blood, and to lessen the over excitement of a fluid become too stimulating.

The use of aqueous drink is not the most effectual method of allaying thirst. A traveller exposed to the scorching heat of summer, finds it advantageous to mix spirits to plain water, which alone does not stimulate sufficiently the mucous and salivary glands, whose secretion moistens the inside of the mouth and pharynx, and covers these surfaces with the substance best calculated to suspend, at least for a time, the erethism on which thirst appears to depend.—*Richerand's Physiology.*

by repletion. It is not the province of the present page to speculate, with the physician, upon the danger of surfeits; or, with the moralist, upon the nauseousness of gluttony: it will only be proper to observe, that as nothing is so prejudicial to health as hunger by constraint, so nothing is more beneficial to the constitution than voluntary abstinence. It was not without reason that religion enjoined this duty; since it answered the double purpose of restoring the health oppressed by luxury, and diminished the consumption of provisions, so that a part might come to the poor. It should be the business of the legislature, therefore, to enforce this divine precept; and thus, by restraining one part of mankind in the use of their superfluities, to consult for the benefit of those who want the necessaries of life. The injunctions for abstinence are strict over the whole Continent; and were rigorously observed even among ourselves, for a long time after the Reformation. Queen Elizabeth, by giving her commands upon this head the air of a political injunction, lessened, in a great measure, and in my opinion very unwisely, the religious force of the obligation. She enjoined that her subjects should fast from flesh on Fridays and Saturdays; but at the same time declared, that this was not commanded from motives of religion, as if there were any differences in meats, but merely to favour the consumption of fish, and thus to multiply the number of mariners; and also to spare the stock of sheep, which might be more beneficial in another way. In this manner the injunction defeated its own force; and this most salutary law became no longer binding, when it was supposed to come purely from man. How far it may be enjoined in the Scripture, I will not take upon me to say; but this may be asserted, that if the utmost benefit to the individual, and the most extensive advantage to society, serve to mark any institution as of Heaven, this of abstinence may be reckoned among the foremost.

Were we to give an history of the various benefits that have arisen from this command, and how conducive it has been to long life, the instances would fatigue with their multiplicity. It is surprising to what a great age the primitive Christians of the East, who retired from persecution in the deserts of Arabia, continued to live, in all the bloom of health, and yet all the rigours of abstemious discipline. Their common allowance, as we are told, for four and twenty hours, was twelve ounces of bread, and nothing but water. On this simple beverage, St Anthony is said to have lived a hundred and five years: James, the hermit, a hundred and four; Arsenius, tutor to the emperor Arcadius, a hundred and twenty; St Epiphanius, a hundred and fifteen; Simeon, a hundred and twelve; and Rombald, a hundred and twenty. In this manner did these holy temperate men live to an extreme old age, kept cheerful by strong hopes, and healthful by moderate labour.

Abstinence, which is thus voluntary, may be much more easily supported than constrained hunger. Man is said to live without food for seven days; which is the usual limit assigned him; and perhaps, in a state of constraint, this is the longest time he can survive the want of it. But in cases of voluntary abstinence, of sickness, or sleeping, he has been known to live much longer.

In the records of the Tower, there is an account of a Scotchman imprisoned for felony, who for the space of six weeks took not the least sustenance, being exactly watched during the whole time; and for this he received the king's pardon.[1]

When the American Indians undertake long journeys, and when, consequently, a stock of provisions sufficient to support them the whole way, would be more than they could carry; in order to obviate this inconvenience, instead of carrying the necessary quantity, they contrive a method of palliating their hunger, by swallowing pills, made of calcined shells and tobacco. These pills take away all appetite, by producing a temporary disorder in the stomach; and, no doubt, the frequent repetition of this wretched expedient must at last be fatal. By these means, however, they continue several days without eating, cheerfully bearing such extremes of fatigue and watching, as would quickly destroy men bred up in a greater state of delicacy. For those arts by which we learn to obviate our necessities, do not fail to unfit us for their accidental encounter.

---

[1] It is a pity Goldsmith was not more explicit on this almost incredible case. We do not recollect of ever having seen it adverted to elsewhere, and we are inclined to suppose it a gratuitous illustration of the old English creed regarding the hunger-enduring capabilities of the Scotch. There are, however, authentic instances of long abstinence from food. Captain Bligh, of the Bounty, sailed nearly 4000 miles in an open boat, with occasionally a single small bird, not many ounces in weight, for the daily sustenance of seventeen people; and it is even alleged, that fourteen men and women of the Juno, having suffered shipwreck on the coast of Arracan, lived twenty-three days without any food. Two people first died of want on the fifth day. In the opinion of Rhedi, animals support want much longer than is generally believed. A civet cat lived ten days without food, an antelope twenty, and a very large wild cat also twenty; an eagle survived twenty-eight days, a badger one month, and several dogs thirty-six days. In the memoirs of the Academy of Sciences there is an account of a bitch, which having been accidentally shut up alone in a country-house, existed for forty days without any other nourishment than the stuff on the wool of a matrass which she had torn to pieces. A crucodile will live two months without food, a scorpion three, a bear six, a chameleon eight, and a viper ten. Vaillant had a spider that lived nearly a year without food, and was so far from being weakened by abstinence, that it immediately killed another large spider, equally vigorous, but not so hungry, which was put in along with it. John Hunter inclosed a toad between two stone flower-pots, and found it as lively as ever after fourteen months. Land-tortoises have lived without food for eighteen months; and Baker is known to have kept a beetle in a state of total abstinence for three years. It afterwards made its escape. Dr Shaw gives an account of two serpents which lived in a bottle without any food for five years.

Upon the whole, therefore, man is less able to support hunger than any other animal; and he is not better qualified to support a state of watchfulness. Indeed, sleep seems much more necessary to him, than to any other creature: as, when awake, he may be said to exhaust a greater portion of the nervous fluid; and, consequently, to stand in need of an adequate supply. Other animals, when most awake, are but little removed from a state of slumber; their feeble faculties, imprisoned in matter, and rather exerted by impulse than deliberation, require sleep, rather as the cessation from motion, than from thinking. But it is otherwise with man; his ideas, fatigued with their various excursions, demand a cessation, not less than the body, from toil: and he is the only creature that seems to require sleep from double motives; not less for the refreshment of the mental than of the bodily frame.

There are some lower animals, indeed, that seem to spend the greatest part of their lives in sleep; properly speaking, the sleep of such may be considered as a kind of death; and their waking a resurrection. Flies and insects are said to be asleep, at a time that all the vital motions have ceased, without respiration, without any circulation of their juices; if cut in pieces, they do not awake, nor does any fluid ooze out of the wound. These may be considered rather as congealed than as sleeping animals; and their rest, during winter, rather as a cessation from life, than a necessary refreshment; but in the higher races of animals, whose blood is not thus congealed, and thawed by heat, these all bear want of sleep much better than man; and some of them continue a long time without seeming to take any refreshment from it whatsoever.

But man is more feeble; he requires its due return; and if it fails to pay the accustomed visit, his whole frame is in a short time thrown into disorder: his appetite ceases; his spirits are dejected; his pulse becomes quicker and harder; and his mind, abridged of its slumbering visions, begins to adopt waking dreams. A thousand strange phantoms arise, which come and go without his will: these, which are transient in the beginning, at last take firm possession of the mind, which yields to their dominion, and after a long struggle, runs into confirmed madness. In that horrid state, the mind may be considered as a city without walls, open to every insult, and paying homage to every invader; every idea that then starts with any force, becomes a reality; and the reason, over fatigued with its former importunities, makes no head against the tyrannical invasion, but submits to it from mere imbecility.

But it is happy for mankind, that this state of inquietude is seldom driven to an extreme; and that there are medicines which seldom fail to give relief. However, man finds it more difficult than any other animal to procure sleep: and some are obliged to court its approaches for several hours together, before they incline to rest. It is in vain that all light is excluded; that all sounds are removed; that warmth and softness conspire to invite it; the restless and busy mind still retains its former activity; and Reason, that wishes to lay down the reins, in spite of herself is obliged to maintain them. In this disagreeable state, the mind passes from thought to thought, willing to lose the distinctness of perception, by increasing the multitude of the images. At last, when the approaches of sleep are near, every object of the imagination begins to mix with that next it; their outlines become, in a manner, rounder; a part of their distinctions fades away; and sleep, that ensues, fashions out a dream from the remainder.

If then it should be asked, from what cause this state of repose proceeds, or in what manner sleep thus binds us for several hours together? I must fairly confess my ignorance; although it is easy to tell what philosophers may say upon the subject. Sleep, says one of them,[1] consists in a scarcity of spirits, by which the orifices or pores of the nerves in the brain, through which the spirits used to flow into the nerves, being no longer kept open by the frequency of the spirits, shut of themselves; thus the nerves, wanting a new supply of spirits, become lax, and unfit to convey any impression to the brain. All this, however, is explaining a very great obscurity by somewhat more obscure; leaving, therefore, those spirits to open and shut the entrances to the brain, let us be contented with simply enumerating the effects of sleep upon the human constitution.

In sleep, the whole nervous frame is relaxed, while the heart and the lungs seem more forcibly exerted.[2] This fuller circulation produces also a swelling of the muscles, as they always find who sleep with ligatures on any part of their body. This increased circulation also, may be considered as a kind of exercise, which is continued through the frame; and by this, the perspiration becomes more copious, although the appetite for food is entirely taken away. Too much sleep dulls

---

[1] Robault.

[2] The causes of excitation to which our organs are exposed during waking, tend to increase progressively their action: the pulsations of the heart, for instance,

---

are much more frequent in the evening than in the morning, and this motion, gradually accelerated, would soon be carried to a degree of activity incompatible with the continuance of life, did not sleep daily temper this energy, and bring it down to its due measure. Fever is occasioned by long continued want of sleep, and in all acute diseases, the exacerbation comes on towards evening, the night's sleep abates again the high excitation of power: but this state of the animal economy, so salutary and so desirable in all sthenic affections, is more injurious than useful in diseases, consisting chiefly in extreme debility. Adynamy shows itself, almost always, in the morning, in putrid fevers; and petechiæ, a symptom of extreme weakness, break out during sleep. This state is, likewise, favourable to the coming on and to the progress of gangrene, and this is a pathological fact well ascertained. In all the cases mentioned, sleep does not improve the condition of the patients; a thing easy to conceive, since it only adds to accidental debility, the essential characteristic of the disease, weakness. which is also its principal characteristic.

Sleep, that momentary interruption in the communication of the senses with outward objects, may be defined the repose of the organs of sense, and of voluntary motion. During sleep, the inward or assimilating functions are going on: digestion, absorption, circulation, respiration, secretion, nutrition, are carried on; some, as absorption and nutrition, with more energy than during waking, whilst others are evidently slackened. During sleep, the pulse is slower and weaker, inspiration is less frequent, insensible perspiration, urine, and all other humours derived from the blood, are separated in smaller quantity. Absorption is, on the contrary, very active: hence the danger of falling asleep in the midst of a noxious air. It is known that the marshy effluvia, which make the Campagna di Roma so unhealthy, bring on, almost inevitably, intermittent fevers, when the night is passed there, whilst travellers, who go through without stopping, are not affected by it.

Sleep is a state essentially different from death, to which some authors have erroneously likened it. It merely suspends that portion of life, which serves to keep up with outward objects an intercourse necessary to our existence. One may say that sleep and waking call each other, and are of mutual necessity. The organs of sense and motion, weary of acting, rest; but there are many circumstances favouring this cessation of their activity. A continual excitation of the organs of sense would keep them continually awake; the removal of the material causes of our sensations tends, therefore, to plunge us into the arms of sleep; wherefore we indulge in it more voluptuously in the gloom and the stillness of night. Our organs fall asleep one after the other; the smell, the taste, and the sight are already at rest, when the hearing and the touch still send up faint impressions. The perceptions, awhile confused, in the end disappear: the internal senses cease acting; as well as the muscles allotted to voluntary motion, whose action is entirely subject to that of the brain.

Sleep is a state, if not altogether passive, in which, at least, the activity of most of the organs is remarkably diminished, and that of some of them completely suspended. It is erroneously, then, that some authors have viewed it as an active phenomenon, and a function of the living economy: it is only a mode or manner of being. It is to no purpose they have maintained, that to sleep required some measure of strength. Excessive fatigue hinders sleep, merely by a sense of pain in all the muscles, a pain that excites anew the action of the brain, which it keeps awake, till it is itself overpowered by sleep.

It has been attempted to show the proximate cause of sleep. Some have said that it depends on the collapse of the laminæ of the cerebellum, which, as they conceive, are in a state of erection during waking; and they argue from the experiment in which by compressing the cerebellum of a living animal, sleep is immediately brought on. This sleep, like that produced by compression of any other part of the cerebral mass, is really a state of disease; and no more natural than apoplexy. Others, conceiving sleep, no doubt, analogous to this affection, ascribe it to the collection of humours upon the brain, during waking. This organ, say they, compressed by the blood which obstructs its vessels, falls into a state of real stupor. An opinion as unsupported as the other. As long as the humours flow in abundance towards the brain, they keep up in it an excitement which is altogether unfavourable to sleep. Do we not know, that it is enough that the brain be strongly occupied by its thoughts, or vividly affected, in any way, to repel sleep? Coffee, spirituous liquors, in small quantities, will produce sleeplessness, by exciting the force of circulation, and determining towards the brain, a more considerable afflux of blood. All, on the other hand, that may divert this fluid towards another organ, as copious bleedings, pediluvium, purges, digestion, copulation, severe cold, or whatever diminishes the force with which it is driven towards it, as inebriation, general debility, tends powerfully to promote sleep. In like manner, is it observed, that while it lasts, the cerebral mass collapses; a sign that the flow of blood into it is remarkably lessened.

The organs of the senses, laid asleep, in succession, awake in the same manner. Sounds and light produce impressions, confused at first, on the eyes and ears; in a little time, these sensations grow distinct; we smell, we taste, we judge of bodies by the touch. The organs of motion prepare for entering into action, and begin to act, at the direction of the will. The causes of waking operate by determining a greater flow of blood into the brain: they include all that can affect the senses, as the return of light and of noise with the rising of the sun; at times, they act within us. Thus, urine, fecal matter, other fluids accumulated in their reservoirs, irritate them, and send up, towards the brain, an agitation which assists in dispelling slumber. Habit too, acts upon this phenomenon, as on all those of the nervous and sensitive system, with most remarkable influence. There are many that sleep soundly amidst noises which, at first kept them painfully awake. Whatever need he may have of longer repose, a man that has fixed the daily hour of his awaking, will awake every morning to his hour. It is as much under the control of the will. It is enough to will it strongly, and we can awake at any hour we choose.

Although sleep implies the perfect repose of the organs of sensation and of motion, some of these organs persist in their activity; which obliges us to acknowledge intermediate states between sleep and waking, real mixed situations, which belong, more or less, to one or to the other. Let us suppose, for instance, that the imagination reproduces, in the brain, sensations it has formerly known, the intellect works, associates and combines ideas, often discordant, and sometimes natural, brings forth monsters, horrible, or fantastic or ridicuthe apprehension, weakens the memory, and unfits the body for labour. On the contrary, sleep too much abridged, emaciates the frame produces melancholy, and consumes the constitution. It requires some care, therefore, to regulate the quantity of sleep, and just to take as much as will completely restore nature, without oppressing it. The poor, as Otway says, sleep little; forced by their situation, to lengthen out their labour to their necessities, they have but a short interval for this pleasing refreshment; and I have ever been of opinion, that bodily labour demands a less quantity of sleep than mental. Labourers and artizans are generally satisfied with about seven hours; but I have known some scholars who usually slept nine, and perceived their faculties no way impaired by oversleeping.

The famous Philip Barrettiere, who was considered as a prodigy of learning at the age of fourteen, was known to sleep regularly twelve hours in the twenty-four; the extreme activity of his mind, when awake, in some measure called for an adequate alternation of repose: and, I am apt to think, that when students stint themselves in this particular, they lessen the waking powers of the imagination, and weaken its most strenuous exertions. Animals that seldom think, as was said, can very easily dispense with sleep; and of men, such as think least, will, very probably, be satisfied with the smallest share. A life of study, it is well known, unfits the body for receiving this gentle refreshment; the approaches of sleep are driven off by thinking: when therefore, it comes at last, we should not be too ready to interrupt its continuance.

Sleep is indeed, to some, a very agreeable period of their existence: and it has been a question in the schools, Which was most happy, the man who was a beggar by night, and a king by day; or he who was a beggar by day, and a king by night? It is given in favour of the nightly monarch, by him who first started the question: "For the dream," says he, "gives the full enjoyment of the dignity, without its attendant inconveniences; while, on the other hand, the king, who supposes himself degraded, feels all the misery of his fallen fortune, without trying to find the comforts of his humble situation. Thus, by day, both states have their peculiar distresses: but, by night, the exalted beggar is perfectly blessed, and the king completely miserable." All this, however, is rather fanciful than just; the pleasure dreams can give us, seldom reaches to our waking pitch of happiness: the mind often, in the midst of its highest visionary satisfactions, demands of itself, whether it does not owe them to a dream; and frequently awakes with the reply.

But it is seldom, except in cases of the highest delight, or the most extreme uneasiness, that the mind has power thus to disengage itself from the dominion of fancy. In the ordinary course of its operations, it submits to those numberless fantastic images that succeed each other, and which, like many of our waking thoughts, are generally forgotten. Of these, however, if any, by their oddity, or their continuance, affect us strongly, they are then remembered; and there have been some who felt their impressions so strongly, as to mistake them for realities, and to rank them among the past actions of their lives.

There are others upon whom dreams seem to have a very different effect; and who, without seeming to remember their impressions the next morning, have yet shown, by their actions during sleep, that they were very powerfully impelled by their dominion. We have numberless instances of such persons who, while asleep, have performed many of the ordinary duties to which they had been accustomed when waking; and, with a ridiculous industry, have completed by night, what they failed doing by day [1] We are

---

tous; raises joy, hope, grief, surprize or terror; and all these fancies, all these emotions are recollected more or less distinctly, when we are again awake, so as to allow no doubt but that the brain has been really in action, during the repose of the organs of sense and emotion. *Dreams* is the name given to these phenomena. Sometimes we speak in sleep, and this brings us a little nearer to the state of waking, since to the action of the brain is added that of the organs of speech. Finally, all the relative functions are capable of action, excepting the outward senses. The brain acts, and determines the action of the organs of motion or speech, only in consequence of former impressions; and this state, which differs from waking only by the inaction of the senses, is called *somnambulism*.—*Richerand's Physiology.*

[1] The newspapers lately gave an account of a servant girl in the neighbourhood of Falkirk, who, having been one evening desired to prepare a baking of cakes early next morning, arose in the night, brought water, of which there happened to be none in the house, from the canal, whence it was commonly taken for the use of the family, baked a large farl, placed it upon the girdle, which she adjusted properly over the grate, but overlooked the necessity of lighting the fire. All this she discovered next morning when she awoke. A relation is given by Henricus ab Heeres, in his *Medical Observations*, of a student whose poetical talent was more lively at such times than when awake. This young man cudgelled his brains sometimes the whole day, in making verses, correcting and blotting them out again; and, not being able to please himself, was forced to leave many gaps till a more lucky sitting. Sometimes, after leaving his compositions in this imperfect state, he would rise in the night, open his desk, fall to writing, fill up the chasms, read aloud what he had written, laugh heartily at what pleased him, and call his chamber-fellow to do the like, and yet all this while he was fast asleep: then putting off his shoes and clothes, shutting his desk, and

told, in the German Ephemerides, of a young student, who being enjoined a severe exercise by his tutor, went to bed, despairing of accomplishing it. The next morning awaking, to his great surprise, he found the task fairly written out, and finished in his own handwriting.

He was at first, as the account has it, induced to ascribe this strange production to the operations of an infernal agent; but his tutor, willing to examine the affair to the bottom, set him another exercise, still more severe than the former, and took precautions to observe his conduct the whole night. The young gentleman, upon being so severely tasked, felt the same inquietude that he had done on the former occasion; went to bed gloomy and pensive, pondering on the next day's duty, and, after some time, fell asleep. But shortly after, his tutor, who continued to observe him from a place that was concealed, was surprised to see him get up, and very deliberately go to the table; where he took out pen, ink, and paper, drew himself a chair, and sat very methodically to thinking: it seems, that his being asleep, only served to strengthen the powers of his imagination; for he very quickly and easily went through the task assigned him; put his chair aside, and then returned to bed to take out the rest of his nap. What credit we are to give to this account, I will not pretend to determine; but this may be said, that the book from whence it was taken, has some good marks of veracity; for it is very learned, and very dull; and is written in a country noted, if not for truth, at least for want of invention.

The ridiculous story of Arlotto is well known, who has had a volume written, containing a narrative of the actions of his life, not one of which was performed while he was awake. He was an Italian Franciscan friar, extremely rigid in his manners, and remarkably devout and learned in his daily conversation. By night, however, and during his sleep, he played a very different character from what he did by day, and was often detected in very atrocious crimes. He was at one time detected in actually attempting a rape, and did not awake till the next morning, when he was surprised to find himself in the hands of justice. His brothers of the convent often watched him while he went very deliberately into the chapel, and there attempted to commit sacrilege. They sometimes permitted him to carry the chalice and the vestments away into his own chamber, and the next morning amused themselves at the poor man's consternation for what he had done. But of all his sleeping transgressions, that was the most ridiculous, in which he was called to pray for the soul of a person departed. Arlotto, after having devoutly performed his duty, retired to a chamber which was shown him, to rest; but there he had no sooner fallen asleep, than he began to reflect that the dead body had got a ring upon one of the fingers, which might be useful to him: accordingly, with a pious resolution of stealing it, he went down, undressed as he was, into a room full of women, and, with great composure, endeavoured to seize the ring. The consequence was, that he was taken before the inquisition for witchcraft; and the poor creature had like to have been condemned, till his peculiar character accidentally came to be known; however, he was ordered to remain for the rest of life in his own convent, and on no account whatsoever to stir abroad.

What are we to say to such actions as these? or how account for this operation of the mind in dreaming? It should seem that the imagination, by day, as well as by night, is always employed; and that often against our wills, it intrudes, where it is least commanded or desired. While awake, and in health, this busy principle cannot much delude us: it may build castles in the air, and raise a thousand phantoms before us; but we have every one of the senses alive to bear testimony to its falsehood. Our eyes show us that the prospect is not present; our hearing and our touch depose against its reality; and our taste and smelling are equally vigilant in detecting the imposture. Reason, therefore, at once gives judgment upon the cause, and the vagrant intruder, Imagination, is imprisoned, or banished from the mind. But in sleep it is otherwise; having, as much as possible, put our senses from their duty, having closed the eyes from seeing, and the ears, taste, and smelling, from their peculiar functions, and having diminished even the touch itself, by all the arts of softness, the imagination is then

---

laying his papers aside, he went to bed again, and slept till he was called up, utterly ignorant of what he had written, said, or done in the night time. In the morning, returning to his studies, and finding the blanks in his verses filled up with his own hand, he was at a loss to know whether it was done by man or some evil genius and was in great perplexity, till his fellow-students set his mind at rest by a recital of his behaviour during his sleep. Some time after, he left the schools, and betaking himself to a virtuous wife, was haunted by the same infirmity, would rise in the night, take the child out of the cradle, walk about the house with it, and answer any question truly that his wife then propounded to him, which he would not do at other times. About the fortieth year of his age, and to his great satisfaction, this custom left him, unless he had drunk hard overnight. His wife and whole family, that had seen him walking, reading, and writing, being desired to observe it, affirmed that he spoke as plainly as if he had been awake, and that his eyes were open all the time, of which he was wholly ignorant, and sincerely protested he saw not at all, and remembered nothing of what they said he had done.

left to riot at large, and to lead the understanding without an opposer. Every incursive idea then becomes a reality; and the mind, not having one power that can prove the illusion, takes them for truths. As in madness, the senses, from struggling with the imagination, are at length forced to submit; so, in sleep, they seem for a while soothed into the like submission: the smallest violence exerted upon any one of them, however, rouses all the rest in their mutual defence; and the imagination, that had for a while told its thousand falsehoods, is totally driven away, or only permitted to pass under the custody of such as are every moment ready to detect its imposition.

CHAP. VII.

OF SEEING.[1]

"Having mentioned the senses as correcting the errors of the imagination, and, as forcing it, in some measure, to bring us just information, it will naturally follow, that we should examine the nature of those senses themselves: we shall thus be enabled to see how far they also impose on us, and how far they contribute to correct each other. Let it be observed, however, that in this we are neither giving a treatise of optics or phonics, but a history of our own perceptions: and to those we chiefly confine ourselves."

The eyes[2] very soon begin to be formed in the human embryo, and in the chicken also. Of all the parts which the animal has double, the eyes are produced the soonest, and appear the most prominent. It is true, indeed, that

---

[1] This chapter is taken from Mr Buffon. I believe the reader will readily excuse any apology; and, perhaps, may wish that I had taken this liberty much more frequently. What I add is marked, as in a former instance, with inverted commas.—*Note by Goldsmith.*

[2] The eyes are so placed as to command a great extent of objects at once, and are enclosed in two osseous cavities, known by the name of orbits. The base of these cavities is forwards, and shaped obliquely outwards; so that their outward side not being so long as the others, the ball of the eye supported, on that side, only by soft parts, may be directed outwards and take cognizance of objects placed to a side, without its being necessary, at the same time, to turn the head. In proportion as we descend from man in the scale of animated beings, the shape of the base of the orbits becomes more and more oblique; the eyes cease to be directed forward, in short, the external side of the socket disappears, and the sight is entirely directed outward, and as the physiognomy derives its principal character from the eyes, its expression is absolutely changed. In certain animals very fleet in running, such as the hare, the lateral situation of the organs of vision, prevents the animals from seeing small objects, placed directly before them, hence those animals, when closely pursued, are so easily caught in the snares which are laid for them.

The organ of sight consists of three essentially distinct parts. The one set intended to protect the eyeball, to screen it, at times, from the influence of light, and to maintain it in the conditions necessary to the exercise of its functions; these parts are the eye-brows, the eyelids, and the lachrymal apparatus, and they serve as appendages of the organ. The eye-ball itself contains two parts answering very different purposes; the one, formed by nearly the whole globe, is a real optical instrument, placed immediately in front of the retina, and destined to produce on the luminous rays those changes which are indispensable, in the mechanism of vision; the other, formed by the medullary expansion of the optic nerve, is the immediate organ of that function. It is the retina, which alone is affected by the impression of light, and set in motion by the contact of that very subtle fluid. This impression is transmitted to the cerebral organ, by the optic nerve, the expansion of which forms the retina.

The more or less dark colour of the hairs of the eyebrows, renders that projection very well adapted to diminish the effect of too vivid a light, by absorbing a part of its rays. The eye-brows answer this purpose, the more completely, from being more projecting, and from the darker colour of the hairs which cover them; hence we depress the eye-brows, by knitting them traversely, in passing from the dark, into a place strongly illuminated, which causes an uneasy sensation to the organ of sight. Hence, likewise, the custom that prevails with some southern nations, whose eye-brows are shaded by thicker and darker hairs, to blacken them, that they may still better answer the purpose for which they are intended.

The eye-lids are two movable curtains, placed before the eyes which they alternately cover and uncover. It was requisite that they should be on the stretch and yet capable of free motion; now, both these ends are obtained by the tarsal cartilages, which are situated along the whole of their free edges and of the muscles which enter into their structure. The cellular tissue, which unites the thin and delicate skin of the eye-lids to the muscular fibres, contains, instead of a consistent fat, which would have impeded its motion, a gelatinous lymph which, when in excess, constitutes œdema of the eye-lids. The tissue of the eye-lids is not absolutely opaque, since, even when strongly drawn together, and completely covering the globe of the eye, one may still discern through their texture, light from darkness. On that account, light may be considered as one of the causes of awakening, and it is of consequence to keep in the dark, patients fatigued by want of sleep.

The principal use of the eye-lids is to shade the eyes from the continual impression of light. Like all the other organs, the eyes require to recruit themselves by repose; and they had not been able to enjoy it, if the incessant impression of the luminous rays had continually excited their sensibility. The removal of the eye-lids is attended with loss of sleep. The fluids are determined to the affected organ which suffers from incessant irritation. The eyes inflame, the inflammation spreads towards the brain, and the patient expires in the most dreadful agony. Thanks to an advanced state of civilization, these barbarous tortures have long been abolished; but what happens, when from ectropium of one or other of the eye-lids, a small portion of the sclerotic coat or cornea remains uncovered, proves the indispensable necessity of those parts. The spot exposed to the continued action of the air and of the light, becomes irritated and inflamed, and there comes on an ophthalmia, which can be cured only, by bringing together, by means of a surgical operation, the divided edges of the opening which is the cause of the affection. From the movable edges of both eye-lids, there arise short curved in viviparous animals, and particularly in man, they are not so large in proportion, at first, as in the oviparous kinds; nevertheless, they are more speedily developed, when they begin to appear, than any other parts of the body. It is the same with the organ of hearing; the little bones that compose the internal parts of the ear are entirely formed before the other bones, though much larger, have acquired any part of their growth or solidity. Hence it appears, that those parts of the body which are furnished with the greatest quantity of nerves, are the first in forming. Thus the brain and the spinal-marrow, are the first seen begun in the embryo; and, in general, it may be said, that wherever the nerves go, or send their branches in great numbers, there the parts are soonest begun, and the most completely finished.

If we examine the eyes of a child some hours, or even some days after its birth, it will be easily discerned that it as yet makes no use of them. The humour of the organ not having acquired a sufficient consistence, the rays of light strike but confusedly upon the retina, or expansion of nerves at the back of the eye. It is not till about a month after they are born, that children fix them upon objects; for, before that time, they turn them indiscriminately everywhere, without appearing to be affected by any. At six or seven weeks old, they plainly discover a choice in the objects of their attention; they fix their eyes upon the most brilliant colours, and seem peculiarly desirous of turning them towards the light. Hitherto, however, they only seem to fortify the organ for seeing distinctly; but they have still many illusions to correct.

The first great error in vision is, that the eye inverts every object: and it in reality appears to the child, until the touch has served to undeceive it, turned upside down. A second error in vision is, that every object appears double. The same object forms itself distinctly upon each eye; and is consequently seen twice. This error, also, can only be corrected by the touch; and although, in reality, every object we see appears inverted and double, yet the judgment and habit have so often corrected the sense, that we no longer submit to its imposition, but see every object in its just position, the very instant it appears. Were we therefore, deprived of feeling, our eyes would not only misrepresent the situation, but also the number, of all things around us.

To convince us that we see objects inverted, we have only to observe the manner in which images are represented, coming through a small hole in a darkened room. If such a small hole be made in a dark room, so that no light can come in, but through it, all the objects without will be painted on the wall behind, but in an inverted position, their heads downwards. For as all the rays which pass from the different parts of the object without, cannot enter the hole in the same extent which they had in leaving the object; since, if so, they would require the aperture to be as large as the object; and, as each part and every point of the object sends forth the image of itself on every side, and the rays which form these images pass from all points of the object as from so many centres, so such only can pass through the small aperture as come in opposite directions. Thus the little aperture becomes a centre for the entire object; through which the rays from the upper parts, as well as from the lower parts of it, pass in converging directions; and consequently, they must cross each other, in the central point, and thus paint the objects behind, upon the wall, in an inverted position.

It is, in like manner, easy to conceive, that we see all objects double, whatever our present sensations may seem to tell us to the contrary. For to convince us of this, we have only to compare the situation of any one object on shutting one eye, and then compare the same situation by shutting the other. If, for instance, we hold up a finger and shut the right eye, we shall find it hide a certain part of the room; if again re-shutting the other eye, we shall find that part of the room visible, and the finger seeming to cover a part of the room that had been visible before. If we open both eyes, however, the part covered will appear to lie between the two extremes. But the truth is, we see the object our finger had covered, one image of it to the right, and the other to the left; but, from habit, suppose that we see but one image placed between both; our sense of feeling having corrected the errors of sight. And thus, also, if instead of two eyes, we had two hundred, we should, at first, fancy the objects increased in proportion, until one sense had corrected another.

---

hairs, of the same colour as those of the eye-brows; they are called eye-lashes, and are intended to prevent insects, or other very light substances, floating in the atmosphere, from getting between the eye-ball and the eye-lids.

The anterior part of the eye, thus defended against external injuries, is continually moistened by the tears. The organ which secretes this fluid, is a small gland situated in a depression at the anterior and external part of the arch of the orbit, imbedded in fat, and supplied with vessels and nerves in proportion to its bulk, and pouring the fluid it secretes, by means of seven or eight ducts which open on the internal surface of the upper eye-lid, by capillary orifices directed downward and inward. The tears are a muco-serous fluid, rather heavier than distilled water, saltish, changing to a green colour, vegetable blues, and containing soda, muriate and carbonate of soda, and a very small quantity of phosphate of soda and of lime.—*Richerand's Physiology.*

" The having two eyes might thus be said to be rather an inconvenience than a benefit; since one eye would answer the purposes of sight as well, and be less liable to illusion. But it is otherwise; two eyes greatly contribute, if not to distinct, at least to extensive vision.[1] When an object is placed at a moderate distance, by the means of both eyes we see a larger share of it than we possibly could with one, the right eye seeing a greater portion of its right side, and the left eye of its corresponding side. Thus both eyes, in some measure, see round the object; and it is this that gives it, in nature, that bold relievo, or swelling, with which they appear; and which no painting, how exquisite soever, can attain to. The painter must be contented with shading on a flat surface; but the eyes, in observing nature, do not behold the shading only, but a part of the figure also, that lies behind those very shadings which give it that swelling which painters so ardently desire, but can never fully imitate.

" There is another defect, which either of the eyes taken singly would have, but which is corrected, by having the organ double. In either eye there is a point, which has no vision whatsoever; so that if one of them only is employed in seeing, there is a part of the object to which it is always totally blind. This is that part of the optic nerve where its vein and artery run; which being insensible, that point of the object that is painted there must continue unseen. To be convinced of this we have only to try a very easy experiment. If we take three black patches, and stick them upon a white wall, about a foot distant from each other, each about as high as the eye that is to observe them; then retiring six or seven feet back, and shutting one eye, by trying for some time, we shall find, that while we distinctly behold the black spots that are to the right and left, that which is in the middle remains totally unseen. Or, in other words, when we bring that part of the eye, where the optic artery runs, to fall upon the object, it will then become invisible. This defect, however, in either eye, is always corrected by both, since the part of the object that is unseen by one, will be very distinctly perceived by the other."

Besides the former defects, we can have no idea of distances from the sight without the help of touch. Naturally every object we see appears to be within our eyes; and a child, who has as yet made but little use of the sense of feeling, must suppose that every thing it sees makes a part of itself. Such objects are only seen more or less bulky, as they approach or recede from its eyes; so that a fly that is near will appear larger than an ox at a distance. It is experience alone that can rectify this mistake; and a long acquaintance with the real size of every object quickly assures us of the distance at which it is seen.—The last man in a file of soldiers appears in reality much less, perhaps ten times more diminutive, than the man next to us; however, we do not perceive this difference, but continue to think him of equal stature; for the numbers we have seen thus lessened by distance, and have found, by repeated experience, to be of the natural size when we come closer, instantly correct the sense, and every object is perceived with nearly its natural proportion. But it is otherwise, if we observe objects in such situations as we have not had sufficient experience to correct the errors of the eye; if, for instance, we look at men from the top of a high steeple, they, in that case, appear very much diminished, as we have not had a habit of correcting the sense in that position

Although a small degree of reflection will serve to convince us of the truth of these positions, it may not be amiss to strengthen them by an authority which cannot be disputed. Mr Cheselden having couched a boy of thirteen for a cataract, who had hitherto been blind, and thus at once having restored him to sight, curiously marked the progress of his mind upon that occasion. This youth, though he had been till then incapable of seeing, yet was not totally blind, but could tell day from night, as persons in his situation always may. He could also, with a strong light, distinguish black from white, and either from the vivid colour of scarlet: however he saw nothing of the form of bodies; and without a bright light, not even colours themselves. He was at first couched only in one of his eyes; and when he saw for the first time, he was so far from judging of distances, that he supposed his eye touched every object that he saw, in the same manner as his hands might be said to feel them. The objects that were most agreeable to him were such as were of plain surfaces and regular figures: though he could as yet make no judgment whatever of their different forms, nor give a reason why one pleased him more than another. Although he could form some idea of colours during his state of blindness, yet that was not sufficient to direct him at present; and he could scarcely be persuaded that the colours he now saw were the same with those he had formerly conceived such erroneous ideas of. He delighted most in green; but black objects, as if giving him an idea of his former blindness, he regarded with horror. He had, as was said, no idea of forms; and was unable to distinguish one object from another, though ever so different. When those things were shown him, which he had been formerly familiarized to by his feeling, he beheld them with earnestness, in order to remember them a second time: but as he had too many to recollect at once, he forgot the greatest number; and for one he could tell, after seeing, there was a thousand he was totally unacquainted with. He was very much surprised to find, that those things and persons he loved best, were not the most beautiful to be seen; and even testified displeasure in not finding his parents so handsome as he conceived them to be. It was near two months before he could find that a picture resembled a solid body. Till then he only considered it as a flat surface variously shadowed; but when he began to perceive that these kind of shadings actually represented human beings, he then began to examine, by his touch whether they had not the usual qualities of such bodies, and was greatly surprised to find, what he expected a very unequal surface, to be smooth and even. He was then shown a miniature-picture of his father, which was contained in his mother's watch-case, and he readily perceived the resemblance; but asked with great astonishment, how so large a face could be contained in so small a compass? It seemed as strange to him, as if a bushel was contained in a pint vessel. At first he could bear but a very small quantity of light, and he saw every object much greater than the life; but in proportion as he saw objects that were really large, he seemed to think the former were diminished; and although he knew the chamber where he was contained in the house, yet, until he saw the latter, he could not be brought to conceive how a house could be larger than a chamber. Before the operation, he had no great expectations from the pleasures he should receive from a new sense; he was only excited by the hopes of being able to read and write; he said, for instance, that he could have no great pleasure in walking in the garden with his sight, than he had without it, for he walked there at his ease, and was acquainted with all the walks. He remarked also, with great justice, that his former blindness gave him one advantage over the rest of mankind, which was that of being able to walk in the night with confidence and security. But when he began to make use of his new sense, he seemed transported beyond measure. He said, that every object was a new source of delight, and that his pleasure was so great as to be past expression. About a year after, he was brought to Epsom, where there was a very fine prospect, with which he seemed greatly charmed; and he called the landscape before him a new method of seeing. He was couched in the other eye, a year after the former, and the operation succeeded equally well: when he saw with both eyes, he said that objects appeared to him twice as large as when he saw but with one; however he did not see them doubled, or, at least, he showed no marks as if he saw them so. Mr Cheselden mentions instances of many more that were restored to sight in this manner; they all seemed to concur in their perceptions with this youth: and they all seemed particularly embarassed in learning how to direct their eyes to the objects they wished to observe.

---

[1] Leonardo da Vinci.

In this manner it is that our feeling corrects the sense of seeing, and that objects which appear of very different sizes at different distances, are all reduced, by experience, to their natural standard. "But not the feeling only, but also the colour and brightness of the object, contribute, in some measure, to assist us in forming an idea of the distances at which it appears.[1] Those which we see most strongly marked with light and shade, we readily know to be nearer than those on which the colours are more faintly spread, and that, in some measure, take a part of their hue from the air between us and them. Bright objects also are seen at a greater distance than such as are obscure, and, most probably, for this reason, that being less similar in colour, to the air which interposes, their impressions are less effaced by it, and they continue more distinctly visible. Thus a black and distant object is not seen so far off as a bright and glittering one, and a fire by night is seen much farther off than by day."

The power of seeing objects at a distance is very rarely equal in both eyes. When this inequality is in any great degree, the person so circumstanced then makes use only of one eye, shutting that which sees the least, and employing the other with all its power. And hence proceeds that awkward look which is known by the name of *strabism*.

There are many reasons to induce us to think that such as are near-sighted see objects larger than other persons; and yet the contrary is most certainly true, for they see them less. Mr Buffon informs us that he himself is short-sighted, and that his left eye is stronger than his right. He has very frequently experienced, upon looking at any object, such as the letters of a book, that they appear less to the weakest eye; and that when he places the book, so as that the letters appear double, the images of the left eye, which is strongest, are greater than those of the right, which is the most feeble. He has examined several others, who were in similar circumstances, and has always found that the best eye saw every object the largest. This he ascribes to habit; for near-sighted people being accustomed to come close to the object, and view but a small part of it at a time, the habit ensues, when the whole of an object is seen, and it appears less to them than to others.

---

[1] Mr Buffon gives a different theory, for which I must refer the reader to the original. That I have given, I take to be easy and satisfactory enough—*Note by Goldsmith.*

Infants having their eyes less than those of adults, must see objects also smaller in proportion. For the image formed on the back of the eye will be large, as the eye is capacious; and infants having it not so great cannot have so large a picture of the object. This may be a reason also why they are unable to see so distinctly, or at such distances, as persons arrived at maturity.

Old men, on the contrary, see bodies close to them very indistinctly, but bodies at a great distance from them with more precision; and this may happen from an alteration in the coats, or perhaps, humours of the eye; and not, as is supposed, from their diminution. The cornea, for instance, may become too rigid to adapt itself, and take a proper convexity for seeing minute objects; and its very flatness will be sufficient to fit it for distant vision.

When we cast our eyes upon an object extremely brilliant, or when we fix and detain them too long upon the same object, the organ is hurt and fatigued, its vision becomes indistinct, and the image of the body which has thus too violently or perseveringly employed us, is painted upon every thing we look at, and mixes with every object that occurs. "And this is an obvious consequence of the eye taking in too much light, either immediately, or by reflection. Every body exposed to the light, for a time, drinks in a quantity of its rays, which being brought into darkness, it cannot instantly discharge. Thus the hand, if it be exposed to broad day-light for some time, and then immediately snatched into a dark room, will appear still luminous: and it will be some time before it is totally darkened. It is thus with the eye; which either by an instant gaze at the sun, or a steady continuance upon some less brilliant object, has taken in too much light; its humours are, for a while, unfit for vision, until that be discharged, and room made for rays of a milder nature." How dangerous the looking upon bright and luminous objects is to the sight may be easily seen, from such as live in countries covered for most part of the year with snow, who become generally blind before their time. Travellers who cross these countries are obliged to wear a crape before their faces, to save their eyes, which would otherwise be rendered totally unserviceable; and it is equally dangerous in the sandy plains of Africa. The reflection of the light is there so strong, that it is impossible to sustain the effect, without incurring the danger of losing one's sight entirely. Such persons, therefore, as read or write for any continuance, should choose a moderate light, in order to save their eyes; and although it may seem insufficient at first, the eye will accustom itself to the shade, by degrees, and be less hurt by the want of light than the excess.

"It is, indeed, surprising how far the eye can accommodate itself to darkness, and make the best of a gloomy situation. When first taken from the light, and brought into a dark room, all things disappear; or, if any thing is seen, it is only the remaining radiations that still continue in the eye. But, after a very little time, when these are spent, the eye takes the advantage of the smallest ray that happens to enter; and this alone would, in time, serve for many of the purposes of life. There was a gentleman of great courage and understanding, who was a major under King Charles I.; this unfortunate man, sharing in his master's misfortunes, and being forced abroad, ventured to Madrid to do his king a signal service; but unluckily failed in the attempt. In consequence of this, he was instantly ordered to a dark and dismal dungeon, into which the light never entered, and into which there was no opening but by a hole at the top, down which the keeper put his provisions, and presently closed it again on the other side. In this manner the unfortunate loyalist continued for some weeks, distressed and disconsolate; but at last he began to think he saw some glimmering of light. This internal dawn seemed to increase from time to time, so that he could not only discover the parts of his bed, and such other large objects, but at length, he even began to perceive the mice that frequented his cell; and saw them as they ran about the floor, eating the crumbs of bread that happened to fall. After some months' confinement he was set free; but such was the effect of the darkness upon him, that he could not, for some days, venture to leave his dungeon, but was obliged to accustom himself by degrees to the light of the day."

CHAP. VIII.

OF HEARING.[1]

As the sense of hearing, as well as of sight, gives us notice of remote objects, so, like that, it is subject to similar errors, being capable of imposing on us upon all occasions, where we cannot rectify it by the sense of feeling.

---

[1] This chapter is taken from Mr Buffon, except where marked by inverted commas.—*Note by Goldsmith.*

We can have from it no distinct intelligence of the distance from whence a sounding body is heard; a great noise far off, and a small one very near, produce the same sensation; and unless we receive information from some other sense, we can never distinctly tell whether the sound be a great or small one. It is not till we have learned, by experience, that the particular sound which is heard, is of a peculiar kind; then we can judge of the distance from whence we hear it. When we know the tone of the bell, we can then judge how far it is from us.

Every body that strikes against another produces a sound, which is simple, and but one in bodies which are not elastic, but which is often repeated in such as are. If we strike a bell, or a stretched string, for instance, which are both elastic, a single blow produces a sound, which is repeated by the undulations of the sonorous body, and which is multiplied as often as it happens to undulate or vibrate. These undulations each strike their own peculiar blow: but they succeed so fast, one behind the other, that the ear supposes them one continued sound; whereas, in reality, they make many. A person who should, for the first time, hear the toll of the bell, would, very probably, be able to distinguish these breaks of sound; and, in fact, we can readily ourselves perceive an intension and premission in the sound.

In this manner, sounding bodies are of two kinds; those unelastic ones, which, being struck, return but a single sound; and those more elastic, returning a succession of sounds; which, uniting together, form a tone. This tone may be considered as a great number of sounds, all produced one after the other by the same body, as we find in a bell, or the string of a harpsichord, which continues to sound for some time after it is struck. A continuing tone may also be produced from a non-elastic body, by repeating the blow quick and often, as when we beat a drum, or when we draw a bow along the string of a fiddle.

Considering the subject in this light, if we should multiply the number of blows, or repeat them at quicker intervals upon the sounding body, as upon the drum, for instance, it is evident that this will have no effect in altering the tone; it will only make it either more even, or more distinct. But it is otherwise, if we increase the force of the blow: if we strike the body with double weight, this will produce a tone twice as loud as the former. If, for instance, I strike a table with a switch, this will be very different from the sound produced by striking it with a cudgel. Hence, therefore, we may infer, that all bodies give a louder and graver tone, not in proportion to the number of times they are struck, but in proportion to the force that strikes them. And, if this be so, those philosophers who make the tone of a sonorous body, of a bell, or the string of a harpsichord, for instance, to depend upon the number only of its vibrations, and not the force, have mistaken what is only an effect for a cause. A bell, or an elastic string, can only be considered as a drum beaten; and the frequency of the blows can make no alteration whatever in the tone. The largest bells, and the longest and thickest strings, have the most forceful vibrations; and, therefore, their tones are the most loud and the most grave.

To know the manner in which sounds thus produced become pleasing, it must be observed, no one continuing tone, how loud and swelling soever, can give us satisfaction; we must have a succession of them, and those in the most pleasing proportion. The nature of this proportion may be thus conceived. If we strike a body incapable of vibration with a double force, or, what amounts to the same thing, with a double mass of matter, it will produce a sound that will be doubly grave. Music has been said by the ancients to have been first invented from the blows of different hammers on an anvil. Suppose then we strike an anvil with a hammer of one pound weight, and again with a hammer of two pounds, it is plain that the two-pound hammer will produce a sound twice as grave as the former. But if we strike with a two-pound hammer, and then with a three-pound, it is evident that the latter will produce a sound one-third more grave than the former. If we strike the anvil with a three-pound hammer, and then with a four-pound, it will likewise follow that the latter will be a quarter part more grave than the former. Now, in the comparing between all those sounds, it is obvious that the difference between one and two is more easily perceived, than between two and three, three and four, or any numbers succeeding in the same proportion. The succession of sounds will be, therefore, pleasing in proportion to the ease with which they may be distinguished. That sound which is double the former, or, in other words, the octave to the preceding tone, will, of all others, be the most pleasing harmony. The next to that, which is as two or three, or, in other words, the third, will be most agreeable. And thus, universally, those sounds whose difference may be most easily compared, are the most agreeable.

"Musicians, therefore, have contented themselves with seven different proportions of sound, which are called *notes*, and which sufficiently answer all the purposes of pleasure. Not but that they might adopt a greater diversity of proportions; and some have actually done so;

but, in these, the differences of the proportion are so imperceptible, that the ear is rather fatigued than pleased in making the distinction. In order, however, to give variety, they have admitted half tones; but in all the countries where music is yet in its infancy, they have rejected such; and they can find music in none but the obvious ones. The Chinese, for instance, have neither flats nor sharps in their music; but the intervals between their other notes, are in the same proportion with ours.

"Many more barbarous nations have their peculiar instruments of music; and, what is remarkable, the proportion between their notes is in all the same as in ours. This is not the place for entering into the nature of these sounds, their effects upon the air, or their consonances with each other. We are not now giving a history of sound, but of human perception.

"All countries are pleased with music,[1] and if they have not skill enough to produce harmony, at least they seem willing to substitute noise. Without all question, noise alone is sufficient to operate powerfully on the spirits; and, if the mind be already predisposed to joy, I have seldom found noise fail of increasing it into rapture. The mind feels a kind of distracted pleasure in such powerful sounds, braces up every nerve, and riots in the excess. But, as in the eye, an immediate gaze upon the sun will disturb the organs, so, in the ear, a loud unexpected noise disorders the whole frame, and sometimes disturbs the sense ever after. The mind must have time to prepare for the expected shock, and to give its organs the proper tension for its arrival.

"Musical sounds, however, seem of a different kind. Those are generally most pleasing which are most unexpected. It is not from bracing up the nerves, but from the grateful succession of the sounds, that these become so charming. There are few, how indifferent soever, but have at times felt their pleasing impression; and, perhaps, even those who have stood out against the powerful persuasion of sounds, only wanted the proper tune, or the proper instrument, to allure them.

"The ancients give us a thousand strange instances of the effects of music, upon men and animals. The story of Arion's harp, that gathered the dolphins to the ship's side, is well known; and what is remarkable, Schotteus assures us,[2] that he saw a similar instance of fishes being allured by music. They tell us of diseases that have been cured, unchastity corrected, seditions quelled, passions removed, and sometimes excited even to madness. Dr Wallis has endeavoured to account for these surprising effects, by ascribing them to the novelty of the art. For my own part, I can scarcely hesitate to impute them to the exaggeration of the writers. They are as hyperbolical in the effects of their oratory; and yet, we well know, there is nothing in the orations which they have left us, capable of exciting madness, or of raising the mind to that ungovernable degree of fury which they describe. As they have exaggerated, therefore, in one instance, we may naturally suppose that they have done the same in the other; and, indeed, from the few remains we have of their music, collected by Meibomius, one might be apt to suppose there was nothing very powerful in what is lost. Nor does any one of the ancient instruments, such as we see them represented in statues, appear comparable to our fiddle.

"However this be, we have many odd accounts, not only among them, but the moderns, of the power of music; and it must not be denied, but that on some particular occasions, musical sounds may have a very powerful effect. I have seen all the horses and cows in a field, where there were above a hundred, gathered round a person that was blowing a French horn, and seeming to testify an awkward kind of satisfaction. Dogs are well known to be very sensible of different tones in music; and I have sometimes heard them sustain a very ridiculous part in a concert, where their assistance was neither expected nor desired.

"We are told of Henry IV. of Denmark,[3] that being one day desirous of trying in person whether a musician, who boasted that he could excite men to madness, was not an impostor, he submitted to the operation of his skill: but the consequence was much more terrible than he expected; for, becoming actually mad, he killed four of his attendants in the midst of his transports. A contrary effect of music we have, [1] in the cure of a madman of Alais, in France, by music. This man, who was a dancing-master, after a fever of five days, grew furious, and so ungovernable that his hands were obliged to be tied to his sides: what at first was rage, in a short time was converted into silent melancholy, which no arts could exhilarate, nor any medicines remove. [2] In this sullen and dejected state, an old acquaintance accidentally came to inquire after his health; he found him sitting up in bed, tied, and totally regardless of every external object round him. Happening, however, to take up a fiddle that lay in the room, and touching a favourite air, the poor madman instantly seemed to brighten up at the sound; from a recumbent posture, he began to sit up; and, as the musician continued playing, the patient seemed desirous of dancing to the sound: but he was tied, and incapable of leaving his bed, so that he could only humour the tune with his head, and those parts of his arms which were at liberty. Thus the other continued playing, and the dancing-master practised his own art, as far as he was able, for about a quarter of an hour, when suddenly falling into a deep sleep, in which his disorder came to a crisis, he awaked perfectly recovered.

---

[1] Nolrega (a Jesuit) had a school, where he instructed the native children, the orphans from Portugal, and the *mestizos*, or mixed breed. Reading, writing, and arithmetic were taught them; they were trained to assist at mass, and *to sing* the church service, and frequently led in procession through the town. This had a great effect, for the natives were passionately fond of music, so passionately, that Nolrega began to hope the fable of Orpheus was a type of his mission, and that by songs he was to convert the pagans of Brazil. This Jesuit usually took with him four or five of these little choristers on his preaching expeditions; when they approached an inhabited place, one carried the crucifix before them, and they began singing the Litany. The savages, like snakes, were won by the voice of the charmer; they received him joyfully, and when he departed with the same ceremony, the children followed the music. He set the catechism, creed, and ordinary prayers to *sol fa;* and the pleasure of learning to sing was such a temptation, that the little Tupis sometimes ran away from their parents to put themselves under the care of the Jesuit. —*Southey's History of Brazil.*

[2] Quod oculis meis spectavi. Schottei Magic. universalis, pars. ii. lib. 1. p. 26.

[3] Olai Magni, lib. 15. hist. c. 28.

"A thousand other instances might be added, equally true: let it suffice to add one more, which is not true; I mean that of the tarantula. [3] Every person who has been in Italy now well knows, that the bite of that animal, and its being cured by music, is all a deception. When strangers come into that part of the country, the country people are ready enough to take money for dancing to the tarantula. A friend of mine had a servant who suffered himself to be bit; the wound, which was little larger than the puncture of a pin, was uneasy for a few hours, and then became well without any further assistance. Some of the country people, however, still make a tolerable livelihood from the credulity of strangers, as the musician finds his account in it not less than the dancer."

Sounds, like light, are not only extensively diffused, but are frequently reflected. [4] The laws of this reflection, it is true, are not as well understood as those of light; all we know is, that sound is principally reflected by hard bodies; and their being hollow, also, sometimes increases the reverberation. "No art, however, can make an echo; and some who have bestowed great labour and expence upon such a project, have only erected shapeless buildings, whose silence was a mortifying lecture upon their presumption."

The internal cavity of the ear seems to be fitted up for the purpose of echoing sound with the greatest precision. [5] This part is fashioned out of the temporal bone, like a cavern cut into a rock. "In this the sound is repeated and articulated; and, as some anatomists tell us, (for we have as yet but very little knowledge on this subject,) is beaten against the tympanum, or drum of the ear, which moves four little bones joined thereto; and these move and agitate the internal air which lies on the other side; and lastly, this air strikes and affects the auditory nerves which carry the sound to the brain."

One of the most common disorders in old

---

[1] Hist. de l'Acad. 1708, p. 22.

[2] Of the solace of music, nay, more, of its influence upon melancholy, I need not look for evidence in the universal testimony of antiquity, nor remind such an audience of its recorded effect upon the gloomy distemper of the perverse mind of Saul. I myself have witnessed its power to mitigate the sadness of seclusion, in a case where my loyalty as a good subject, and my best feelings as a man, were more than usually interested in the restoration of my patient; and I also remember its salutary operation in the case of a gentleman in Yorkshire many years ago, who was first stupified, and afterwards became insane upon the sudden loss of all his property. This gentleman could hardly be said to live—he merely vegetated, for he was motionless until pushed, and did not speak to, nor notice anybody in the house, for nearly four months. The first indication of a return of any sense appeared in his attention to music played in the street. This was observed, the second time he heard it, to have a more decided force in arousing him from his lethargy; and induced by this good omen, the sagacious humanity of his superintendent offered him a violin. He seized it eagerly, and amused himself with it constantly. After six weeks, hearing the rest of the patients of the house pass by his door to their common room, he accosted them "Good morning to you all, gentlemen, I am quite well, and desire I may accompany you." In two months more he was dismissed cured.—*Sir Henry Halford's Essays and Orations.*

[3] The Peccorara and Tarantella are the dances of Calabria: the latter is generally adopted throughout the kingdom of Naples. The music accompanying it is extravagant and without melody: it consists of some notes, the movement of which is always increasing, till it ends in producing a convulsive effort. Two persons placed opposite to each other make, like a pair of savages, wild contortions and indecent gestures, which terminate in a sort of delirium. This dance, originating in the city of Tarentum, has given rise to the fable of the Tarantula, whose venomous bite, it is pretended, can be cured only by music and hard dancing. Many respectable persons who have resided for a long time in the city of Tarentum, have assured me that they never witnessed any circumstance of the kind, and that it could be only attributed to the heat and insalubrity of the climate, which produce nervous affections that are soothed and composed by the charms of music. The Tarantula is a species of spider that is to be found all over the South of Italy. The Calabrians do not fear it, and I have often seen our soldiers hold it in their hands without any bad effects ensuing.—*Calabria, during a Military Residence.*

[4] Sound is, however, not like light,—a body having a distinct existence.

[5] It is said, that the external part of the ear may be removed without perceptibly impairing the hearing.

age is deafness; which probably proceeds from the rigidity of the nerves in the labyrinth of the ear. This disorder, also, sometimes proceeds from a stoppage of the wax, which art may easily remedy. In order to know whether the defect be an internal, or an external one, let the deaf person put a repeating watch into his mouth, and if he hears it strike, he may be assured that his disorder proceeds from an external cause, and is, in some measure, curable: "for there is a passage from the ears into the mouth, by what anatomists call the *eustachian tube;* and, by this passage, people often hear sounds, when they are utterly without hearing through the larger channel: and this also is the reason that we often see persons who listen with great attention, hearkening with their mouths open, in order to catch all the sound at every aperture."

It often happens, that persons hear differently with one ear from the other; and it is generally found that these have what is called, by musicians, *a bad ear.* Mr Buffon, who has made many trials upon persons of this kind, always found that their defect in judging properly of sounds proceeded from the inequality of their ears; and receiving by both, at the same time, unequal sensations, they form an unjust idea. In this manner, as those people hear false, they also, without knowing it, sing false. Those persons also frequently deceive themselves with regard to the side from whence the sound comes, generally supposing the noise to come on the part of the best ear.

Such as are hard of hearing, find the same advantage in the trumpet made for this purpose, that short-sighted persons do from glasses. These trumpets might be easily improved so as to increase sounds, in the same manner that the telescope does objects; however, they could be used to advantage only in a place of solitude and stillness, as the neighbouring sounds would mix with the more distant, and the whole would produce in the ear nothing but tumult and confusion.

Hearing is a much more necessary sense to man than to animals. With these it is only a warning against danger, or an encouragement to mutual assistance. In man, it is the source of most of his pleasure; and without which the rest of his senses would be of little benefit. A man born deaf, must necessarily be dumb; and his whole sphere of knowledge must be bounded only by sensual objects. We have an instance of a young man, who, being born deaf, was restored at the age of twenty-four to perfect hearing: the account is given in the Memoirs of the Academy of Sciences, 1783, page 18.

A young man, of the town of Chartres, between the age of twenty-three and twenty-four, the son of a tradesman, and deaf and dumb from his birth, began to speak all of a sudden, to the great astonishment of the whole town. He gave them to understand, that about three or four months before, he had heard the sound of the bells for the first time, and was greatly surprised at this new and unknown sensation. After some time, a kind of water issued from his left ear, and he then heard perfectly well with both. During these three months, he was sedulously employed in listening, without saying a word, and accustoming himself to speak softly (so as not to be heard) the words pronounced by others. He laboured hard also in perfecting himself in the pronunciation, and in the ideas attached to every sound. At length, having supposed himself qualified to break silence, he declared, that he could now speak, although as yet but imperfectly. Soon after, some able divines questioned him concerning his ideas of his past state; and principally with respect to God, his soul, the morality or turpitude of actions. The young man, however, had not driven his solitary speculations into that channel. He had gone to mass indeed with his parents, and learned to sign himself with the cross, to kneel down and assume all the grimaces of a man that was praying; but he did all this without any manner of knowledge of the intention or the cause; he saw others do the like, and that was enough for him; he knew nothing even of death, and it never entered into his head; he led a life of pure animal instinct; entirely taken up with sensible objects, and such as were present, he did not seem even to make as many reflections upon these, as might reasonably be expected from his improving situation: and yet the young man was not in want of understanding; but the understanding of a man deprived of all commerce with others, is so very confined, that the mind is in some measure totally under the control of its immediate sensations.

Notwithstanding, it is very possible to communicate ideas to deaf men, which they previously wanted, and even give them very precise notions of some abstract subjects, by means of signs and of letters. A person born deaf, may, by time, and sufficient pains, be taught to write and read, to speak, and by the motions of the lips, to understand what is said to him; however, it is probable that, as most of the motions of speech are made within the mouth by the tongue, the knowledge from the motion of the lips is but very confined; "nevertheless, I have conversed with a gentleman thus taught, and in all the commonly occurring questions, and the usual salutations, he was ready enough, merely by attending to the motion of the lips alone. When

I ventured to speak for a short continuance, he was totally at a loss, although he understood the subject, when written, extremely well." Persons taught in this manner, were at first considered as prodigies; but there have been so many instances of success of late, and so many are skilful in the art of instructing in this way, that though still a matter of some curiosity, it ceases to be an object of wonder.[1]

CHAP. IX.

OF SMELLING, FEELING, AND TASTING.

An animal may be said to fill up that sphere, which he can reach by his senses; and is actually large in proportion to the sphere to which its organ extends. By sight, man's enjoyments are diffused into a wide circle; that of hearing, though less widely diffused, nevertheless extends his powers; the sense of smelling is more contracted still; and the taste and touch are the most confined of all. Thus man enjoys very distant objects but with one sense only; more nearly he brings two senses at once to bear upon them; his sense of smelling assists the other two, at its own distance; and of such objects, as a man, he may be said to be in perfect possession.

Each sense, however, the more it acts at a distance, the more capable it is of making combinations; and is, consequently, the more improveable. Refined imaginations, and men of strong minds, take more pleasure, therefore, in improving the delights of the distant senses, than in enjoying such as are scarce capable of improvement.

By combining the objects of the extensive senses, all the arts of poetry, painting, and harmony, have been discovered; but the closer senses, if I may so call them, such as smelling, tasting, and touching, are, in some measure, as simple as they are limited, and admit of little variety. The man of imagination makes a great and an artificial happiness by the pleasure of altering and combining; the sensualist just stops where he began, and cultivates only those pleasures which he cannot improve. The sensualist is contented with those enjoyments that are already made to his hand; but the man of pleasure is best pleased with growing happiness.

Of all the senses, perhaps, there is not one in which man is more inferior to other animals than in that of smelling. With man, it is a sense that acts in a narrow sphere, and disgusts almost as frequently as it gives him pleasure. With many other animals it is diffused to a very great extent; and never seems to offend them. Dogs not only trace the steps of other animals, but also discover them by the scent at a very great distance; and while they are thus exquisitely sensible of all smells, they seem no way disgusted by any.

But, although this sense is, in general, so very inferior in man, it is much stronger in those nations that abstain from animal food, than among Europeans. The Bramins of India have a power of smelling, as I am informed, equal to what it is in other creatures.

---

[1] It has been long established as an indisputable fact, that all our senses can be very much quickened by frequent exercise of them, as is frequently manifested in persons born blind or deaf. We shall illustrate this by one of the most striking examples on record, namely, that of an individual who was born both blind and deaf. An account of him by Dugald Stewart is given in the Transactions of the Royal Society of Edinburgh.

James Mitchell, the son of a clergyman, in the county of Nairn, in Scotland, was born on the 11th November, 1795. His mother soon noticed his blindness, from his discovering no desire to turn his eyes to the light, or to any bright object; and in early infancy she ascertained his deafness, from observing that the loudest noises did not disturb his sleep. He early showed an extraordinary acuteness of the senses of touch and smell. When a stranger arrived, his smell invariably informed him of the circumstance, and directed him to the place where a stranger was, whom he proceeded to survey by the sense of touch. In the remote situation where he resided, male visitors were most frequent; and, therefore, the first thing he generally did was to examine whether or not the stranger wore boots; if so, he immediately went to the lobby, felt for, and accurately examined the whip; then proceeded to the stable, and handled his horse with great care, and with the utmost seeming attention. To these various things he was guided by the senses of smell and touch alone. From his childhood he had been accustomed to strike his fore-teeth with a key, or any instrument that gave a sharp sound. His chief gratification in this amusement was obviously derived from taste and smell. He found great amusement, also, in the exercise of touch, and often employed himself, for hours together, in gathering, from the bed of the river, round and smooth stones, which he afterwards arranged in a circular form, seating himself in the midst of the circle. The information of his understanding, and the guidance of his conduct, seemed entirely to depend either on touch, or the organs of smell and taste. His docility and contrivance often indicated a degree of understanding which, if due allowance be made for his want of two of the most essential organs to man and animals—sight and hearing, was superior to that of many in whom every inlet is unobstructed through which the materials of knowledge enter the mind. He had received a severe wound in his foot, and during its cure he usually sat by the fireside, with his foot resting on a small footstool. More than a year afterwards, a servant boy with whom he used to play was obliged to confine himself at home from a similar cause. Young Mitchell, perceiving that his companion remained longer in one situation than he used to do, examined him attentively, and seemed quickly to discover, by the bandages on his feet, the reason of his confinement. He immediately walked up stairs to a garret, sought out, amid several other pieces of furniture, the little footstool on which he formerly supported his own wounded limb, brought it down in his hand to the kitchen, and gently placed the servant boy's foot upon it.

They can smell the water which they drink, that to us seems quite inodorous; and have a word, in their language, which denotes a country of fine water. We are told also, that the negroes of the Antilles, by the smell alone, can distinguish between the footsteps of a Frenchman and a negro.[1] It is possible, therefore, that we may dull this organ by our luxurious way of living; and sacrifice to the pleasures of taste, those which might be received from perfume.

However, it is a sense that we can, in some measure, dispense with; and I have known many that wanted it entirely, with but very little inconvenience from its loss. In a state of nature it is said to be useful in guiding us to proper nourishment, and deterring us from that which is unwholesome; but, in our present situation, such information is but little wanted; and, indeed, but little attended to. In fact, the sense of smelling gives us very often false intelligence. Many things that have a disagreeable odour, are, nevertheless, wholesome and pleasant to the taste; and such as make eating an art, seldom think a meal fit to please the appetite, till it begins to offend the nose. On the other hand, there are many things that smell most gratefully, and yet are noxious, or fatal to the constitution. Some physicians think that perfumes in general are unwholesome; that they relax the nerves, produce headaches, and even retard digestion. The manchineel apple, which is known to be deadly poison, is possessed of the most grateful odour. Some of those mineral vapours that are often found fatal in the stomach, smell like the sweetest flowers, and continue thus to flatter till they destroy. This sense, therefore, as it should seem, was never meant to direct us in the choice of food, but appears rather as an attendant than a necessary pleasure.

Indeed, if we examine the natives of different countries, or even different natives of the same, we shall find no pleasure in which they differ so widely as that of smelling. Some persons are pleased with the smell of a rose: while I have known others that could not abide to have it approach them. The savage nations are highly delighted with the smell of assafœtida, which is to us the most nauseous stink in nature. It would in a manner seem that our delight in perfumes was made by habit; and that a very little industry could bring us totally to invert the perception of odours.

Thus much is certain, that many bodies which at one distance are an agreeable perfume, when nearer are a most ungrateful odour. Musk and ambergrise, in small quantities, are considered by most persons as highly fragrant; and yet when in larger masses, their scent is insufferable. From a mixture of two bodies, each whereof is, of itself, void of all smell, a very powerful smell may be drawn. Thus, by grinding quick-lime with sal-ammoniac, may be produced a very fœtid mixture. On the contrary, from a mixture of two bodies, that are separately disagreeable, a very pleasant aromatic odour may be gained. A mixture of aqua-fortis with spirit of wine produces this effect. But not only the alterations of bodies by each other, but the smallest change in us, makes a very great alteration in this sense, and frequently deprives us of it totally. A slight cold often hinders us from smelling; and as often changes the nature of odours. Some persons, from disorder, retain an incurable aversion to those smells which most pleased them before: and many have been known to have an antipathy to some animals, whose presence they instantly perceived by the smell. From all this, therefore, the sense of smelling appears to be an uncertain monitor, easily disordered, and not much missed when totally wanting.

The sense most nearly allied to smelling is that of tasting. This some have been willing to consider merely as a nicer kind of touch, and have undertaken to account, in a very mechanical manner, for the difference of savour. "Such bodies," said they, "as are pointed, happening to be applied to the papillæ of the tongue, excite a very powerful sensation, and give us the idea of saltness. Such, on the contrary, as are of a rounder figure, slide smoothly along the papillæ, and are perceived to be sweet." In this manner they have with minute labour, gone through the variety of imagined forms in bodies, and have given them as imaginary effects. All we can precisely determine upon the nature of tastes is, that the bodies to be tasted must be either somewhat moistened, or, in some measure, dissolved by the saliva, before they can produce a proper sensation: when both the tongue itself and the body to be tasted are extremely dry, no taste whatever ensues. The sensation is then changed; and the tongue, instead of tasting, can only be said, like any other part of the body, to feel the object.

---

[1] Martial records a case of a person named Mamurra, who consulted nothing but his nose, to know if the copper that had been brought to him was of the true Corinthian. Some native Indian merchants have a still more exquisite sense of smell, for, according to the accounts of travellers in India, if a piece of money is given them, they only smell it, by which they are able to decide exactly its fineness, without touchstone, balance, or aquafortis: even if it be a piece of copper covered over with a leaf of silver, they discover the cheat in the same manner.

In Europe there have been persons whose sense of smelling was equally delicate with that of those natives of India which we have mentioned. Marco Marci speaks of a monk at Prague, who, when any thing was given him, distinguished, by smelling, its qualities, and to whom it belonged.

It is for this reason that children have a stronger relish of taste than those who are more advanced in life. This organ with them, from the greater moisture of their bodies, is kept in greater perfection; and is, consequently, better adapted to perform its functions. Every person remembers how great a pleasure he found in sweets, while a child; but his taste growing more obtuse with age, he is obliged to use artificial means to excite it. It is then that he is found to call in the assistance of poignant sauces, and strong relishes of salts and aromatics; all which the delicacy of his tender organ in childhood was unable to endure. His taste grows callous to the natural relishes, and is artificially formed to others more unnatural; so that the highest epicure may be said to have the most depraved taste; as it is owing to the bluntness of his organ, that he is obliged to have recourse to such a variety of expedients to gratify his appetite.

As smells are often rendered agreeable by habit, so also tastes may be. Tobacco and coffee, so pleasing to many, are yet, at first, very disagreeable to all. It is not without perseverance that we begin to have a relish for them; we force nature so long, that what was constraint in the beginning, at last becomes inclination.

The grossest, and yet the most useful of all the senses, is that of feeling. We are often seen to survive under the loss of the rest; but of this we can never be totally deprived, but with life. Although this sense is diffused over all parts of the body, yet it most frequently happens that those parts which are most exercised in touching, acquire the greatest degree of accuracy. Thus the fingers, by long habit, become greater masters in the art than any other, even where the sensation is more delicate and fine.[1] It is from this habit, therefore, and their peculiar formation, and not, as is supposed, from their being furnished with a greater quantity of nerves, that the fingers are thus perfectly qualified to judge of forms. Blind men, who are obliged to use them much oftener, have this sense much finer; so that the delicacy of the touch arises rather from the habit of constantly employing the fingers, than from any fancied nervousness in their confirmation.

All animals that are furnished with hands[2] seem to have more understanding than others. Monkeys have so many actions like those of men, that they appear to have similar ideas of the form of bodies. All other creatures, deprived of hands, can have no distinct ideas of the shape of the objects by which they are surrounded, as they want this organ, which serves to examine and measure their forms, their risings, and depressions. A quadruped, probably, conceives as erroneous an idea of any thing near him, as a child would of a rock or a mountain that it beheld at a distance.

It may be for this reason, that we often see them frightened at things with which they ought to be better acquainted. Fishes, whose bodies are covered with scales, and who have no organs for feeling, must be the most stupid of all animals. Serpents, that are likewise destitute, are yet, by winding round several bodies, better capable of judging of their form. All these, however, can have but very imperfect ideas from feeling; and we have already seen, when deprived of this sense, how little the rest of the senses are to be relied on.

The feeling, therefore, is the guardian, the judge, and the examiner of all the rest of the senses. It establishes their information, and detects their errors. All the other senses are altered by time, and contradict their former evidence; but the touch still continues the same; and, though extremely confined in its operations, yet it is never found to deceive. The universe, to a man who had only used the rest of his senses, would be but a scene of illusion; every object misrepresented, and all its properties unknown. Mr Buffon has imagined a man just newly brought into existence, describing the illusion of his first sensations, and pointing out the steps by which he arrived at reality. He considers him as just created, and awaking amidst the productions of nature; and, to animate the narrative still more strongly, has made his philosophical man a speaker. The reader will no doubt recollect Adam's speech in Milton as being similar. All that I can say to obviate the imputation of plagiarism is, that the one treats the subject more as a poet, the other more as a philosopher. The philosopher's man describes his first sensations in the following manner.[3]

I well remember that joyful anxious moment when I first became acquainted with my own existence. I was quite ignorant of what I was, how I was produced, or from whence I came. I opened my eyes; what an addition to my surprise! the light of the day, the azure vault of heaven, the verdure of the earth, the crystal of the waters, all employed me at once, and animated and filled me with inexpressible delight. I at first imagined that all those objects were within me, and made a part of myself.

Impressed with this idea, I turned my eyes to the sun; its splendour dazzled and overpowered me; I shut them once more; and, to my great concern, I supposed that during this short interval of darkness, I was again returning to nothing.

---

[1] Buffon, vol. vi. p. 80. [2] Ibid, vol. vi. p. 82.

[3] Buffon, vol. vi. p. 83.

Afflicted, seized with astonishment, I pondered a moment on this great change, when I heard a variety of unexpected sounds. The whistling of the wind, and the melody of the groves, formed a concert, the soft cadence of which sunk upon my soul. I listened for some time, and was persuaded that all this music was within me.

Quite occupied with this new kind of existence, I had already forgotten the light, which was my first inlet into life; when I once more opened my eyes, and found myself again in possession of my former happiness. The gratification of the two senses at once, was a pleasure too great for utterance.

I turned my eyes upon a thousand various objects; I soon found that I could lose them, and restore them at will; and amused myself more at leisure with a repetition of this new-made power.

I now began to gaze without emotion, and to hearken with tranquillity, when a light breeze, the freshness of which charmed me, wafted its perfumes to my sense of smelling, and gave me such satisfaction as even increased my self-love.

Agitated, roused by the various pleasures of my new existence, I instantly arose, and perceived myself moved along, as if by some unknown and secret power.

I had scarcely proceeded forward, when the novelty of my situation once more rendered me immovable. My surprise returned; I supposed that every object around me had been in motion: I gave to them that agitation which I produced by changing place; and the whole creation seemed once more in disorder.

I lifted my hand to my head; I touched my forehead; I felt my whole frame: I then supposed that my hand was the principal organ of my existence; all its informations were distinct and perfect, and so superior to the senses I had yet experienced, that I employed myself for some time in repeating its enjoyments; every part of my person I touched, seemed to touch my hand in turn; and gave back sensation for sensation.

I soon found that this faculty was expanded over the whole surface of my body; and I now first began to perceive the limits of my existence, which I had in the beginning supposed spread over all the objects I saw.

Upon casting my eyes upon my body, and surveying my own form, I thought it greater than all the objects that surrounded me. I gazed upon my person with pleasure; I examined the formation of my hand, and all its motions; it seemed to me large or little in proportion as I approached it to my eyes; I brought it very near, and it then hid almost every other object from my sight. I began soon, however, to find that my sight gave me uncertain information, and resolved to depend upon my feeling for redress.

This precaution was of the utmost service; I renewed my motions, and walked forward with my face turned towards the heavens. I happened to strike lightly against a palm-tree, and this renewed my surprise: I laid my hand on this strange body; it seemed replete with new wonders, for it did not return me sensation for sensation, as my former feelings had done. I perceived that there was something external, and which did not make a part of my own existence.

I now therefore resolved to touch whatever I saw, and vainly attempted to touch the sun; I stretched forth my arm, and felt only yielding air: at every effort, I fell from one surprise into another, for every object appeared equally near me; and it was not till after an infinity of trials, that I found some objects farther removed than the rest.

Amazed with the illusions, and the uncertainty of my state, I sat down beneath a tree; the most beautiful fruits hung upon it within my reach; I stretched forth my hand, and they instantly separated from the branch. I was proud of being able to grasp a substance without me: I held them up, and their weight appeared to me like an animated power that endeavoured to draw them to the earth. I found a pleasure in conquering their resistance.

I held them near to my eye; I considered their form and beauty; their fragrance still more allured me to bring them nearer; I approached them to my lips, and drank in their odours; the perfume invited my sense of tasting, and I soon tried a new sense—How new! how exquisite! Hitherto I had tasted only of pleasure; but now it was luxury. The power of tasting gave me the idea of possession.

Flattered with this new acquisition, I continued its exercise, till an agreeable languor stealing upon my mind, I felt all my limbs become heavy, and all my desires suspended. My sensations were now no longer vivid and distinct; but seemed to lose every object, and presented only feeble images, confusedly marked. At that instant I sunk upon the flowery bank, and slumber seized me. All now seemed once more lost to me. It was then as if I was returning to my former nothing. How long my sleep continued, I cannot tell; as I yet had no perception of time. My awakening appeared like a second birth; and I then perceived that I had ceased for a time to exist. This produced a new sensation of fear; and from this interruption in life, I began to conclude that I was not formed to exist for ever.

In this state of doubt and perplexity, I began to harbour new suspicions; and to fear that sleep had robbed me of some of my late powers; when turning on one side, to resolve my doubts, what was my amazement, to behold another being like myself, stretched by my side! New ideas now began to arise; new passions, as yet unperceived, with fears and pleasures, all took possession of my mind, and prompted my curiosity: love served to complete that happiness which was begun in the individual; and every sense was gratified in all its varieties.

CHAP. X.

OF OLD AGE AND DEATH.[1]

Every thing in nature has its improvement and decay. The human form is no sooner arrived at its state of perfection, than it begins to decline. The alteration is at first insensible; and often several years are elapsed before we find ourselves grown old. The news of this disagreeable change too generally comes from without; and we learn from others that we grow old, before we are willing to believe the report.

When the body has come to its full height and is extended into its just dimensions, it then also begins to receive an additional bulk which rather loads than assists it. This is formed from fat; which generally at the age of thirty-five, or forty, covers all the muscles, and interrupts their activity. Every action is then performed with greater labour, and the increase of size only serves as a fore-runner of decay.

The bones also become every day more solid. In the embryo they are as soft almost as the muscles of the flesh; but by degrees they harden, and acquire their natural vigour; but still, however, the circulation is carried on through them, and how hard soever the bones may seem, yet the blood holds its current through them, as through all other parts of the body. Of this we may be convinced by an experiment, which was first accidentally discovered by our ingenious countryman, Mr Belcher. Perceiving at a friend's house, that the bones of hogs, which were fed upon madder, were red, he tried it upon various animals by mixing this root with their usual food; and he found that it tinctured the bones in all; an evident demonstration that the juices of the body had a circulation through the bones. He fed some animals alternately upon madder and their common food, for some time, and he found their bones tinctured with alternate layers, in conformity to their manner of living. From all this he naturally concluded, that the blood circulated through the bones, as it does through every other part of the body; and that, how solid soever they seemed, yet like the softest parts, they were furnished through all their substance with their proper canals. Nevertheless, these canals are of very different capacities, during the different stages of life. In infancy they are capacious; and the blood flows almost as freely through the bones as through any other part of the body: in manhood their size is greatly diminished; the vessels are almost imperceptible; and the circulation through them is proportionably slow. But, in the decline of life, the blood which flows through the bones, no longer contributing to their growth, must necessarily serve to increase their hardness. The channels that every where run through the human frame, may be compared to those pipes that we every where see crusted on the inside, by the water for a long continuance running through them. Both every day grow less and less, by the small rigid particles which are deposited within them. Thus as the vessels are by degrees diminished, the juices also, which were necessary for the circulation through them are diminished in proportion; till at length, in old age, those props of the human frame are not only more solid, but more brittle.

The cartilages, or gristles, which may be considered as bones beginning to be formed, grow also more rigid. The juices circulating through them, for there is a circulation through all parts of the body, every day contribute to render them harder; so that these substances, which in youth are elastic and pliant, in age become hard and bony. As these cartilages are generally placed near the joints, the motion of the joints also must of consequence become more difficult. Thus, in old age, every action of the body is performed with labour; and the cartilages, formerly so supple, will now sooner break than bend.

"As the cartilages acquire hardness, and unfit the joints for motion, so also that mucous liquor, which is always separated between the joints, and which serves, like oil to a hinge, to give them an easy and ready play, is now grown more scanty. It becomes thicker and more clammy, more unfit for answering the purposes of motion; and from thence, in old age, every joint is not only stiff, but awkward. At every motion this clammy liquor is heard to crack; and it is not without the greatest effort of the muscles that its resistance is overcome. I have seen an old person, who never moved a single joint, that did not thus give notice of the violence done to it."

---

[1] This chapter is taken from Mr Buffon, except where it is marked by inverted commas.—*Note by Goldsmith.*

The membranes that cover the bones, the joints, and the rest of the body become, as we grow old, more dense and more dry. Those which surround the bones, soon cease to be ductile. The fibres, of which the muscles and flesh are composed, become every day more rigid; and while to the touch the body seems, as we advance in years, to grow softer, it is in reality, increasing in hardness. It is the skin, and not the flesh, that we feel upon such occasions. The fat, and the flabbiness of that, seems to give an appearance of softness, which the flesh itself is very far from having. There are few can doubt this, after trying the difference between the flesh of young and old animals. The first is soft and tender, the last is hard and dry.

The skin is the only part of the body that age does not contribute to harden. That stretches to every degree of tension; and we have horrid instances of its pliancy, in many disorders incident to humanity. In youth, therefore, while the body is vigorous and increasing, it still gives way to its growth. But, although it thus adapts itself to our increase; it does not in the same manner conform to our decay. The skin, which in youth was filled and glossy, when the body begins to decline has not elasticity enough to shrink entirely with its diminution. It hangs therefore in wrinkles, which no art can remove. The wrinkles of the body, in general, proceed from this cause. But those of the face seem to proceed from another; namely, from the many varieties of positions into which it is put by the speech, the food, or the passions. Every grimace, and every passion, wrinkles up the visage into different forms. These are visible enough in young persons; but what at first was accidental or transitory, becomes unalterably fixed in the visage as it grows older. "From hence we may conclude, that a freedom from passions not only adds to the happiness of the mind, but preserves the beauty of the face; and the person that has not felt their influence, is less strongly marked by the decays of nature."

Hence, therefore, as we advance in age, the bones, the cartilages, the membranes, the flesh, the skin, and every fibre of the body, become more solid, more brittle, and more dry. Every part shrinks, every motion becomes more slow: the circulation of the fluids is performed with less freedom; perspiration diminishes; the secretions alter; the digestion becomes slow and laborious; and the juices no longer serving to convey their accustomed nourishment, those parts may be said to live no longer when the circulation ceases. Thus the body dies by little and little; all its functions are diminished by degrees; life is driven from one part of the frame to another; universal rigidity prevails; and death at last seizes upon the little that is left.

As the bones, the cartilages, the muscles, and all other parts of the body, are softer in women than in men, these parts must, of consequence, require a longer time to come to that hardness which hastens death. Women, therefore, ought to be a longer time in growing old than men; and this is actually the case. If we consult the tables which have been drawn up respecting human life, we shall find that after a certain age, they are more long-lived than men, all other circumstances the same. A woman of sixty has a better chance than a man of the same age to live till eighty. Upon the whole, we may infer, that such persons as have been slow in coming up to maturity, will also be slow in growing old; and this holds as well with regard to other animals as man.

The whole duration of the life of either vegetables or animals, may be, in some measure, determined from their manner of coming to maturity. The tree or the animal, which takes but a short time to increase to its utmost pitch, perishes much sooner than such as are less premature. In both the increase upwards is first accomplished; and not till they have acquired their greatest degree of height do they begin to spread in bulk. Man grows in stature till about the age of seventeen; but his body is not completely developed till about thirty. Dogs on the other hand, are at their utmost size in a year, and become as bulky as they usually are in another. However, man, who is so long in growing, continues to live fourscore or a hundred years; but the dog seldom above twelve or thirteen. In general also it may be said, that large animals live longer than little ones, as they usually take a longer time to grow. But in all animals one thing is equally certain, that they carry the cause of their own decay about them; and that their deaths are necessary and inevitable. The prospects which some visionaries have formed of perpetuating life by remedies, have been often enough proved false by their own example. Such unaccountable schemes would, therefore, have died with them, had not the love of life always augmented our credulity.

When the body is naturally well formed, it is possible to lengthen out the period of life for some years by management. Temperance in diet is often found conducive to this end. The famous Cornaro, who lived to above a hundred years, although his constitution was naturally feeble, is a strong instance of the benefit of an abstemious life. Moderation in the passions also may contribute to extend the term of our existence. "Fontenelle, the celebrated writer, was naturally of a very weak and delicate habit of body. He was affected by the smallest irregularities; and had frequently suffered severe fits of illness from the slightest causes. But the remarkable equality of his temper, and his seeming want of passion, lengthened out his life to above a hundred. It was remarkable of him, that nothing could vex or make him uneasy; every occurrence seemed equally pleasing; and no event, however unfortunate, seemed to come unexpected." However, the term of life can be prolonged but for a very little time by any art we can use. We are told of men who have lived beyond the ordinary duration of human existence; such as Parr, who lived to a hundred and forty-four; and Jenkins, to a hundred and sixty-five; yet these men used no peculiar arts to prolong life; on the contrary, it appears that these, as well as others, remarkable for their longevity, were peasants accustomed to the greatest fatigues, who had no settled rules of diet, but who often indulged in accidental excesses. Indeed, if we consider that the European, the Negro, the Chinese, and the American, the civilised man and the savage, the rich and the poor, the inhabitant of the city and of the country, though all so different in other respects, are yet entirely similar in the period allotted them for living; if we consider that neither the difference of race, of climate, of nourishment, of convenience, or of soil, makes any difference in the term of life; if we consider that those men who live upon raw flesh, or dried fishes, upon sago, or rice, upon cassava, or upon roots, nevertheless live as long as those who are fed upon bread and meat; we shall readily be brought to acknowledge, that the duration of life depends neither upon habit, customs, or the quantity of food,[1] we shall confess, that nothing can change the laws of that mechanism which regulates the number of our years, and which can chiefly be affected only by long fasting, or great excess.

---

[1] The assertion here made, must be understood as applicable to mankind *en masse*, not to individuals. Unquestionably, there are several essential circumstances which must combine to give any individual a chance of exceeding the usual period assigned to human existence. These may be comprehended under the following heads; a proper configuration of body; being born of healthy parents; living in a healtny climate and good atmosphere; having the command of a sufficient supply of food; constant exercise; a due regulation of sleep; a state of marriage; and due command of the passions and temper.

Most of these particulars seem to be so well established, and are, in themselves, so apparent, that it seems hardly requisite to do more than mention them, to obtain the assent of the mind to their immediate reception. Thus, a deformed person can hardly expect a very long life, nor one born of unhealthy parents; neither can a person inhabiting an unhealthy city or district, expect to escape the dangers with which he is perpetually surrounded. There are some districts, both in Europe and America, where the inhabitants scarcely ever survive thirty-five or forty years. And it is well known that some counties in England, particularly Shropshire, Devonshire, Warwickshire, and Yorkshire, are much more healthy than the rest; whilst Essex, Lincolnshire, and some parts of Kent, are, from the swamps, rendered particularly noxious to human life. All tracts liable to be visited by severe epidemics, too, have seldom produced instances of long life.

It has been remarked, also, that certain families are gifted by Heaven with better stamina and strength, and, therefore, live longer. Quakers, and persons of moderate passions, may be expected to be longer lived than others; but these, in the decline of life, are subject to accessions of low spirits and melancholy, so that they become indolent, and do not resist the attacks of disease. One very singular fact, and well established, is this, that no unmarried person has ever been known, at least in Great Britain, to exceed the age of 100 years. Keeping the passions under due control, and bearing, with fortitude and resignation, the evils of life, is a great means of attaining long life. Longevity is not confined to any nation or country, for instances of it are to be found all over the world; but they are more abundant in cold and temperate climates. Heat seems to relax and enfeeble the body too much; the heart, it may be conceived, is made to beat too rapidly, and the vital power is too soon expended. The vegetable diet, too, of hot countries, does not seem so well calculated for giving the necessary degree of strength and elasticity to the fibre; for although in warm countries more children live to be men and women, yet, as the age of puberty comes on very early, they seldom exceed sixty years. This fact was ascertained, in China, in 1784, when Kien Long ordered all the oldest men in the empire to be brought before him, when, out of a population of two hundred millions, only four persons could be found, whose ages exceeded a hundred; whereas, in Russia, Norway, and other cold countries, instances of longevity are frequent. Thus, in Norway, in 1761, of 6929, who died, 63 were 100 years old: and, in Russia, in 1801, of 726,278 persons, who died, 216 were 100 years old, and 220 had exceeded that age; and one, indeed, was more than 130. The districts of Arcadia, Ætolia, and other parts of Greece, were formerly celebrated for instances of long life; and many of the most distinguished Greeks, such as Pythagoras, Plato, Sophocles, Pindar, &c., attained to a very advanced period of life.

In Italy, when a general census of the inhabitants was made in the year 79, by order of the emperor Vespasian, lord Bacon says there were then living, between the river Po and the Apennines.

54 of 100		2 of 130
57 — 110		1 — 125
2 — 125	Placentia.	1 — 131
4 — 130	Faventia,	6 — 110
4 — 136		4 — 120
3 — 140		1 — 132
3 — 120	Rimini,	1 — 150

The bills of mortality, in Pinsask, in Russia, showed, as follows:—

5 persons of	113
1 ————	113
4 ————	120
1 ————	128
1 ————	130
1 ————	150

The climate of the British islands is very friendly, in general, to the human body; and, in proportion to their size and population, show almost more instances of long life than any other country. Carew, the historian of Cornwall, says, that in that country its inhabitants frequently reach 90 with unimpaired strength of body and mind: but these are the farmers; for the miners seldom live more than 40 years, the fumes of the sulphur, copper, and arsenic, and the damp, killing them all of consumption. But Brown, the Cornish beggar, lived

If there be any difference in the different periods of man's existence, it ought principally to be ascribed to the quality of the air. It has been observed, that in elevated situations there have been found more old people than in those that were low. The mountains of Scotland, Wales, Auvergne, and Switzerland, have furnished more instances of extreme old age, than the plains of Holland, Flanders, Germany, or Poland. But, in general, the duration of life is nearly the same in most countries. Man, if not cut off by accidental diseases, is often found to live to ninety or a hundred years. Our ancestors did not live beyond that date: and, since the times of David, this term has undergone little alteration.

If we be asked, how in the beginning men lived so much longer than at present, and by what means their lives were extended to nine hundred and thirty, or even nine hundred and sixty years; it may be answered, that the productions of the earth, upon which they fed, might be of a different nature at that time from what they are at present. "It may be answered, that the term was abridged by the Divine command, in order to keep the earth from being overstocked with human inhabitants; since, if every person were now to live and generate for nine hundred years, mankind would be increased to such a degree, that there would be no room for subsistence: so that the plan of Providence would be altered; which is seen not to produce life without providing a proper supply."

But to whatever extent life may be prolonged, or however some may have delayed the effects of age, death is the certain goal to which all are hastening. All the causes of decay which have been mentioned contribute to bring on this dreaded dissolution. However, nature approaches to this awful period by slow and imperceptible degrees; life is consumed day after day; and some one of our faculties, or vital principles, is every hour dying before the rest; so that death is only the last shade in the picture; and it is probable that man suffers a greater change in going from youth to age, than from age into the grave. When we first begin to live, our lives may scarcely be said to be our own; as the child grows, life increases in the same proportion; and is at its height in the prime of manhood. But as soon as the body begins to decrease, life decreases also; for as the human frame diminishes, and its juices circulate in smaller quantity, life diminishes and circulates with less vigour; so that as we begin to live by degrees, we begin to die in the same manner.

Why then should we fear death, if our lives have been such as not to make eternity dreadful? Why should we fear that moment, which is prepared by a thousand other moments of the same kind? the first pangs of sickness being probably greater than the last struggles of departure. Death, in most persons, is as calmly endured as the disorder that brings it on. If we inquire from those whose business it is to attend the sick and the dying, we shall find that, except in a very few acute cases, where the patient dies in agonies, the greatest number die quietly, and seemingly without pain: and even the agonies of the former rather terrify the spectators than torment the patient; for how many have we not seen who have been accidentally relieved from this extremity, and yet had no memory of what they then endured? In fact, they had ceased to live during that time when they ceased to have sensation; and their pains were only those of which they had an idea.

The greatest number of mankind die, therefore, without sensation; and of those few that still preserve their faculties entire to the last moment, there is scarcely one of them that does not also preserve the hopes of still outliving his disorder. Nature, for the happiness of man, has rendered this sentiment stronger than his reason. A person dying of an incurable disorder, which he must know to be so, by frequent examples of his case; which he perceives to be so, by the inquietude of all around him, by the tears of his friends, and the departure or the face of the physician, is, nevertheless, still in hopes of getting over it. His interest is so great, that he only attends to his own representations; the judgment of others is considered as a hasty conclusion; and while death every moment makes new inroads upon his constitution, and destroys life in some part, hope still seems to escape the universal ruin, and is the last that submits to the blow.

Cast your eyes upon a sick man, who has a hundred times told you that he felt himself

---

to be 120; and a man, called Polenow, to 130. In Scotland old age is common; 12 persons, in the lower parts of Galloway, were living, a few years ago, of from 100 to 115 years of age. Old William Marshall, a tinker, walked through that country, at 118, with all his faculties perfect. In Montrose, too, in 1812, there were five persons alive from 100 to 110. Small islands and peninsulas, if quite free from marshes, are generally very favourable to long life, and in all latitudes. In the Bermuda islands, many natives reach 100 and more; and in the hurricane at Barbadoes, in 1780, four people were killed who were above 100, and one of 115. Madeira has always been noted for its healthy climate; and a new born infant's chance of life, is there about thirty-nine years, or about a third more than that of one in London. Martin, in his description of the Western islands, speaks of a person in the island of South Uist, aged 130, retaining his appetite and understanding; and also of one Gilbert M'Craw, in the island of Jura, who spent 180 Christmasses in his own house.

dying, that he was convinced he could not recover, and that he was ready to expire; examine what passes on his visage, when through zeal or indiscretion, any one comes to tell him that his end is at hand. You will see him change, like one who is told an unexpected piece of news, he now appears not to have thoroughly believed what he had been telling you himself: he doubted much; and his fears were greater than his hopes; but he still had some feeble expectations of living, and would not have seen the approaches of death, unless he had been alarmed by the mistaken assiduity of his attendants.

Death, therefore, is not that terrible thing which we suppose it to be. It is a spectre which frights us at a distance, but which disappears when we come to approach it more closely. Our ideas of its terrors are conceived in prejudice, and dressed up by fancy; we regard it not only as the greatest misfortune, but as also an evil accompanied with the most excruciating tortures; we have even increased our apprehensions, by reasoning on the extent of our sufferings. "It must be dreadful," say some, "since it is sufficient to separate the soul from the body: it must be long, since our sufferings are proportioned to the succession of our ideas; and these being painful, must succeed each other with extreme rapidity." In this manner has false philosophy laboured to augment the miseries of our nature; and to aggravate that period which nature has kindly covered with insensibility. Neither the mind nor the body can suffer these calamities: the mind is, at that time, mostly without ideas; and the body too much enfeebled to be capable of perceiving its pain. A very acute pain produces either death or fainting, which is a state similar to death: the body can suffer but to a certain degree; if the torture become excessive, it destroys itself; and the mind ceases to perceive, when the body can no longer endure.

In this manner, excessive pain admits of no reflection; and wherever there are any signs of it, we may be sure that the sufferings of the patient are no greater than what we ourselves may have remembered to endure.

But, in the article of death, we have many instances in which the dying person has shown that very reflection which presupposes an absence of the greatest pain; and, consequently, that pang which ends life cannot even be so great as those which have preceded. Thus, when Charles XII. was shot at the siege of Frederickshall, he was seen to clap his hand on the hilt of his sword; and although the blow was great enough to terminate one of the boldest and bravest lives in the world, yet it was not painful enough to produce reflection. He perceived himself attacked; he reflected that he ought to defend himself; and his body obeyed the impulse of his mind, even in the last extremity. Thus it is the prejudice of persons in health, and not the body in pain, that makes us suffer from the approach of death; we have all our lives contracted a habit of making out excessive pleasures and pains; and nothing but repeated experience shows us how seldom the one can be suffered, or the other enjoyed to the utmost.

If there be any thing necessary to confirm what we have said concerning the gradual cessation of life, or the insensible approaches of our end, nothing can more effectually prove it than the uncertainty of the signs of death. If we consult what Winslow or Bruhier have said upon this subject, we shall be convinced, that between life and death the shade is so very undistinguishable, that even all the powers of art can scarcely determine where the one ends, and the other begins. The colour of the visage, the warmth of the body, the suppleness of the joints, are but uncertain signs of life still subsisting; while on the contrary, the paleness of the complexion, the coldness of the body, the stiffness of the extremities, the cessation of all motion, and the total insensibility of the parts, are but uncertain marks of death begun. In the same manner, also, with regard to the pulse and the breathing, these motions are often so kept under, that it is impossible to perceive them. By approaching a looking-glass to the mouth of the person supposed to be dead, people often expect to find whether he breathes or not. But this is a very uncertain experiment; the glass is frequently sullied by the vapour of the dead man's body; and often the person is still alive although the glass is no way tarnished. In the same manner, neither burning nor scarifying, neither noises in the ears nor pungent spirits applied to the nostrils, give certain signs of the discontinuance of life; and there are many instances of persons who have endured them all, and afterwards recovered without any external assistance, to the astonishment of the spectators. How careful, therefore, should we be, before we commit those who are dearest to us to the grave, to be well assured of their departure: experience, justice, humanity, all persuade us not to hasten the funerals of our friends, but to keep their bodies unburied, until we have certain signs of their real decease.

CHAP. XI.

OF THE VARIETIES IN THE HUMAN RACE.

Hitherto we have compared man with other animals; we now come to compare men with each other. We have hitherto considered him as an individual, endowed with excellencies above the rest of the creation; we now come to consider the advantages which men have over men, and the various kinds with which our earth is inhabited.

If we compare the minute differences of mankind, there is scarce one nation upon the earth that entirely resembles another; and there may be said to be as many different kinds of men as there are countries inhabited. One polished nation does not differ more from another, than the merest savages do from those savages that lie even contiguous to them; and it frequently happens that a river, or a mountain, divides two barbarous tribes that are unlike each other in manners, customs, features, and complexion. But these differences, however perceivable, do not form such distinctions as come within a general picture of the varieties of mankind. Custom, accident, or fashion, may produce considerable alterations in neighbouring nations; their being derived from ancestors of a different climate, or complexion, may contribute to make accidental distinctions, which every day grow less; and it may be said, that two neighbouring nations, how unlike soever at first, will assimilate by degrees; and by long continuance, the difference between them will at last become almost imperceptible. It is not, therefore, between contiguous nations we are to look for any strong marked varieties in the human species; it is by comparing the inhabitants of opposite climates and distant countries; those who live within the polar circles, with those beneath the equator; those that live on one side of the globe, with those that occupy the other.

Of all animals, the differences between mankind are the smallest. Of the lower races of creatures, the changes are so great as often entirely to disguise the natural animal, and to distort, or to disfigure, its shape. But the chief differences in man are rather taken from the tincture of his skin than the variety of his figure: as in all climates he preserves his erect deportment, and the marked superiority of his form. If we look round the world, there seem to be not above six[1] distinct varieties in the human species, each of which is strongly marked, and speaks the kind seldom to have mixed with any other. But there is nothing in the shape, nothing in the faculties, that shows their coming from different originals; and the varieties of climate, of nourishment, and custom, are sufficient to produce every change.

The first distinct race of men is found round the polar regions. The Laplanders, the Esquimaux Indians, the Samœid Tartars, the inhabitants of Nova Zembla, the Borandians, the Greenlanders, and the natives of Kamtschatka, may be considered as one peculiar race of people, all greatly resembling each other in their stature, their complexion, their customs, and their ignorance. These nations being under a rigorous climate, where the productions of nature are but few, and the provisions coarse and unwholesome, their bodies have shrunk to the nature of their food; and their complexions have suffered, from cold, almost a similar change to what heat is known to produce; their colour being a deep brown, in some places inclining to actual blackness. These, therefore, in general, are found to be a race of short stature and odd shape, with countenances as savage as their manners are barbarous. The visage in these countries is large and broad, nose flat and short, the eyes of a yellowish brown, inclining to blackness, the eye-lids drawn towards the temples, the cheek-bones extremely high, the mouth very large, the lips thick and turned outwards, the voice thin and squeaking, the head large, the hair black and straight, the colour of the skin of a dark grayish.[1] They are short in stature, the generality not being above four feet high, and the tallest not above five. Among all these nations the women are as deformed as the men, and resemble them so nearly, that one cannot at first distinguish the sexes among them.

These nations not only resemble each other in their deformity, their dwarfishness, the colour of their hair and eyes, but they have, in a great measure, the same inclinations, and the same manners, being all equally rude, superstitious, and stupid. The Danish Laplanders have a large black cat, to which they communicate their secrets, and consult in all their affairs. Among the Swedish Laplanders there is in every family a drum for consulting the devil; and although these nations are robust and nimble, yet they are so cowardly that they never can be brought into the field. Gustavus Adolphus attempted to form a regiment of Laplanders, but he found it impossible to accomplish his design; for it should seem that they can live only in their own country, and in their own manner. They make use of skates, which are made of fir, of near three feet long, and half a foot broad; these are pointed, and raised before, and tied to the foot by straps of leather. With these they skate on the icy snow, and with such velocity, that they very easily overtake the swiftest animals. They make use also of a pole, pointed with iron at one end, and rounded at the other. This pole serves to push them along, to direct their course, to support them from falling, to stop the impetuosity of their motion, and to kill that game which they have overtaken. Upon these skates they descend the steepest mountains, and scale the most craggy precipices; and in these exercises the women are not less skilful than the men. They have all the use of the bow and arrow, which seems to be a contrivance common to all barbarous nations; and which, however, at first, required no small skill to invent. They launch a javelin, also, with great force, and some say, that they can hit a mark no larger than a crown, at thirty yards distance, and with such force as would pierce a man through. They are all hunters; and particularly pursue the ermine, the fox, the ounce, and the martin, for the sake of their skins. These they barter with their southern neighbours, for brandy and tobacco; both which they are fond of to excess. Their food is principally dried fish, the flesh of rein-deers and bears. Their bread is composed of the bones of fishes, pounded and mixed with the inside tender bark of the pine-tree. Their drink is train-oil or brandy; and when deprived of these, water, in which juniper berries have been infused. With regard to their morals, they have all the virtues of simplicity, and all the vices of ignorance. They offer their wives and daughters to strangers; and seem to think it a particular honour if their offer be accepted. They have no idea of religion, or a Supreme Being; the greatest number of them are idolaters; and their superstition is as profound as their worship is contemptible. Wretched and ignorant as they are, yet they do not want pride; they set themselves far above the rest of mankind; and Crantz assures us, that when the Greenlanders are got together, nothing is so customary among them as to turn the Europeans into ridicule. They are obliged, indeed, to yield them the pre-eminence in understanding and mechanic arts; but they do not know how to set any value upon these. They therefore count themselves the only civilized and well-bred people in the world; and it is common with them, when they see a quiet or a modest stranger, to say that he is almost as well bred as a Greenlander.

---

[1] I have taken four of these varieties from Linnæus; those of the Laplanders and Tartars from Mr Buffon —*Note by Goldsmith.*

[1] Crantz.

From this description, therefore, this whole race of people may be considered as distinct from any other.—Their long continuance in a climate the most inhospitable, their being obliged to subsist on food the most coarse and ill-prepared, the savageness of their manners, and their laborious lives, all have contributed to shorten their stature, and to deform their bodies. In proportion as we approach towards the north pole, the size of the natives appears to diminish, growing less and less as we advance higher, till we come to those latitudes that are destitute of all inhabitants whatsoever.

The wretched natives of these climates seem fitted by nature to endure the rigours of their situation. As their food is but scanty and precarious, their patience in hunger is amazing. A man who has eaten nothing for four days can manage his little canoe in the most furious waves, and calmly subsist in the midst of a tempest that would quickly dash an European boat to pieces. Their strength is not less amazing than their patience: a woman among them will carry a piece of timber or a stone, near double the weight of what an European can lift. Their bodies are of a dark grey all over; and their faces brown or olive. The tincture of their skins partly seems to arise from their dirty manner of living, being generally daubed with train-oil; and partly from the rigours of the climate, as the sudden alterations of cold and raw air in winter, and of burning heats in summer, shade their complexions by degrees, till in a succession of generations, they at last become almost black As the countries in which these reside are the most barren, so the natives seem the most barbarous of any part of the earth. Their more southern neighbours of America, treat them with the same scorn that a polished nation would treat a savage one; and we may readily judge of the rudeness of those manners, which even a native of Canada can think more barbarous than his own.

But the gradations of nature are imperceptible; and, while the north is peopled with such miserable inhabitants, there are here and there to be found, upon the edges of these regions, people of a larger stature, and completer figure. A whole race of the dwarfish breed is often found to come down from the north, and settle more to the southward; and, on the contrary, it sometimes happens that southern nations are seen higher up, in the midst of these diminutive tribes, where they have continued for time immemorial. Thus the Ostiac Tartars seem to be a race that have travelled down from the north, and to be originally sprung from the minute savages we have been describing. There are also Norwegians and Finlanders, of proper stature, who are seen to inhabit in latitudes higher even than Lapland. These, however, are but accidental migrations, and serve as shades to unite the distinct varieties of mankind.

The second great variety in the human species, seems to be that of the Tartar race; from whence, probably, the little men we have been describing originally proceeded. The Tartar country, taken in general, comprehends the greatest part of Asia; and is, consequently, a general name given to a number of nations, of various forms and complexions. But, however they seem to differ from each other, they all agree in being very unlike the people of any other country. All these nations have the upper part of the visage very broad, and wrinkled even while yet in their youth. Their noses are short and flat, their eyes little, and sunk in their heads; and, in some of them, they are seen five or six inches asunder. Their cheek-bones are high, the lower part of their visage narrow, the chin long and advanced forward, their teeth of an enormous size, and growing separate from each other; their eyebrows thick, large, and covering their eyes; their eyelids thick, the face broad and flat, the complexion olive-coloured, and the hair black. They are of a middle size, extremely strong, and very robust. They have but little beard, which grows straggling on the chin. They have large thighs, and short legs. The ugliest of all are the Calmucks, in whose appearance there seems to be something frightful. They all lead an erratic life, remaining under tents of hair, or skins. They live upon horse flesh, and that of camels, either raw or a little sodden between the horse and the saddle. They eat also fish dried in the sun. Their most usual drink is mares' milk, fermented with millet ground into meal. They all have the head shaven, except a lock of hair on the top, which they let grow sufficiently long to form into tresses, on each side of the face. The women, who are as ugly as the men, wear their hair, which they bind up with bits of copper, and other ornaments of a like nature. The majority of these nations have no religion, no settled notions of morality, no decency of behaviour. They are chiefly robbers; and the natives of Dagestan, who live near their more polished neighbours, make a traffic of Tartar slaves who have been stolen, and sell them to the Turks and the Persians. Their chief riches consist in horses, of which perhaps there are more in Tartary than in any other part of the world. The natives are taught by custom to live in the same place with their horses, they are continually employed in managing them, and at last bring them to such great obedience, that the horse seems actually to understand the rider's intention.

To this race of men, also, we must refer the Chinese and the Japanese, however different they seem in their manners and ceremonies. It is the form of the body that we are now principally considering; and there is, between these countries, a surprising resemblance. It is in general allowed, that the Chinese have broad faces, small eyes, flat noses, and scarce any beard; that they are broad and square-shouldered, and rather less in stature than Europeans. These are marks common to them and the Tartars, and they may, therefore, be considered as being derived from the same original. "I have observed," says Chardin, "that in all the people from the east and the north of the Caspian sea, to the peninsula of Malacca, that the lines of the face, and the formation of the visage, are the same. This has induced me to believe, that all these nations are derived from the same original, however different either their complexions, or their manners may appear; for as to the complexion, that proceeds entirely from the climate and the food; and as to the manners, these are generally the result of their different degrees of wealth or power." That they come from one stock, is evident also from this, that the Tartars who settle in China, quickly resemble the Chinese; and, on the contrary, the Chinese who settle in Tartary, soon assume the figure and the manners of the Tartars.

The Japanese so much resemble the Chinese, that one cannot hesitate to rank them in the same class They only differ in being rather browner, as they inhabit a more southern climate. They are, in general, described as of a brown complexion, a short stature, a broad flat face, a very little beard, and black hair. Their customs and ceremonies are nearly the same; their ideas of beauty similar; and their artificial deformities of blackening the teeth, and bandaging the feet, entirely alike in both countries. They both, therefore, proceed from the same stock; and although they differ very much from their brutal progenitors, yet they owe their civilization wholly to the mildness of the climate in which they reside, and to the peculiar fertility of the soil. To this tribe, also, we may refer the Cochin Chinese, the Siamese, the Tonquinese, and the inhabitants of Arracan, Laos, and Pegu, who, though all differing from the Chinese and each other, nevertheless have too strong a resemblance not to betray their common original.

Another, which makes the third variety in the human species, is that of the southern Asiatics; the form of whose features and persons may be easily distinguished from those of the Tartar races. The nations that inhabit the peninsula of India, seem to be the principal stock from whence the inhabitants of the islands that lie scattered in the Indian ocean have been peopled. They are, in general, of a slender shape, with long straight black hair, and often with Roman noses. Thus they resemble the Europeans in stature and features; but greatly differ in colour and habit of body. The Indians are of an olive colour, and, in the more southern parts, quite black; although the word Mogul, in their language, signifies a white man. The women are extremely delicate, and bathe very often; they are of an olive colour, as well as the men: their legs and thighs are long, and their bodies short, which is the opposite to what is seen among the women of Europe. They are, as I am assured, by no means so fruitful as the European women; but they feel the pains of childbirth with much less sensibility, and are generally up and well the day following. In fact, these pains seem greatest in all countries where the women are most delicate, or the constitution enfeebled by luxury or indolence. The women of savage nations seem, in a great measure, exempt from painful labours; and even the hard-working wives of the peasants among ourselves, have this advantage from a life of industry, that their child-bearing is less painful. Over all India, the children arrive sooner at maturity, than with us of Europe. They often marry and consummate, the husband at ten years old, and the wife at eight; and they frequently have children at that age. However, the women who are mothers so soon cease bearing before they are arrived at thirty; and at that time they appear wrinkled, and seem marked with all the deformities of age. The Indians have long been remarkable for their cowardice and effeminacy; every conqueror that has attempted the invasion of their country, having succeeded. The warmth of the climate entirely influences their manners; they are slothful, submissive, and luxurious; satisfied with sensual happiness alone, they find no pleasure in thinking; and contented with slavery, they are ready to obey any master. Many tribes among them eat nothing that has life; they are fearful of killing the meanest insect; and have even erected hospitals for the maintenance of all kinds of vermin. The Asiatic dress is a loose flowing garment, rather fitted for the purposes of peace and indolence, than of industry or war. The vigour of the Asiatics is, in general, conformable to their dress and nourishment; fed upon rice, and clothed in effeminate silk vestments, their soldiers are unable to oppose the onset of an European army; and from the times of Alexander to the present day, we have scarcely any instances of their success in arms. Upon the whole, therefore, they may be considered as a feeble race of sensualists, too dull to find rapture in any pleasures, and too indolent to turn their gravity into wisdom. To this class we may refer the Persians, and Arabians, and, in general, the inhabitants of the islands that lie scattered in the Indian ocean.

The fourth striking variety in the human species, is to be found among the negroes of Africa. This gloomy race of mankind is found to blacken all the southern parts of Africa, from eighteen degrees north of the line, to its extreme termination at the Cape of Good Hope. I know it is said, that the Caffres, who inhabit the southern extremity of that large continent, are not to be ranked among the negro race: however, the difference between them, in point of colour and feature, is so small, that they may very easily be grouped in this general picture; and in the one or two that I have seen, I could not perceive the smallest difference. Each of the negro nations, it must be owned, differs from each other; they have their peculiar countries for beauty, like us; and different nations, as in Europe, pride themselves upon the regularity of their features. Those of Guinea, for instance, are extremely ugly, and have an insupportable scent; those of Mosambique are reckoned beautiful, and have no ill smell whatsoever. The negroes, in general, are of a black colour, with a smooth soft skin. This smoothness proceeds from the downy softness of the hair which grows upon it; the strength of which gives a roughness to the feel, in those of a white complexion. Their skins, therefore, have a velvet smoothness, and seem less braced upon the muscles than ours. The hair of their heads differs entirely from what we are accustomed to, being soft, woolly, and short. The beard also partakes of the same qualities; but in this it differs, that it soon turns gray, which the hair is seldom found to do; so that several are seen with white beards, and black hair, at the same time. Their eyes are generally of a deep hazel; their noses flat and short; their lips thick and tumid; and their teeth of an ivory whiteness. This their only beauty, however, is set off by the colour of their skin; the contrast between the black and white being the more observable. It is false to say that their features are deformed by art; since, in the negro children born in European countries, the same deformities are seen to prevail; the same flatness in the nose; and the same prominence in the lips. They are in general said to be well shaped; but of such as I have seen, I never found one that might be justly called so; their legs being mostly ill formed, and commonly bending outward on the shin-bone. But it is not only in those parts of their bodies that are obvious, that they are disproportioned; those parts which among us are usually concealed by dress, with them are large and languid.[1] The women's breasts, after bearing one child, hang down below the navel; and it is customary with them to suckle the child at their backs, by throwing the breasts over the shoulder. As their persons are thus naturally deformed, at least to our imaginations, their minds are equally incapable of strong exertions. The climate seems to relax their mental powers still more than those of the body; they are, therefore, in general, found to be stupid, indolent, and mischievous. The Arabians themselves, many colonies of whom have migrated southward into the most inland parts of Africa, seem to have degenerated from their ancestors; forgetting their ancient learning, and losing their beauty, they have become a race scarcely any way distinguishable from the original natives. Nor does it seem to have fared otherwise with the Portuguese, who, about two centuries ago, settled along this coast. They also are become almost as black as the negroes, and are said by some to be even more barbarous.

---

[1] Linnæus, in prima linea sua, fœminas Africanas depingit sicut aliquid deforme in parte genitali gestantes,

The inhabitants of America make a fifth race, as different from all the rest in colour, as they are distinct in habitation. The natives of America (except in the northern extremity, where they resemble the Laplanders) are of a red or copper colour; and although, in the old world, different climates produce a variety of complexions and customs, the natives of the new continent seem to resemble each other in almost every respect. They are all nearly of one colour; all have black thick straight hair, and thin black beards; which, however, they take care to pluck out by the roots. They have, in general, flat noses, with high cheek-bones, and small eyes; and these deformities of nature they endeavour to increase by art: they flatten the nose, and often the whole head of their children, while the bones are yet susceptible of every impression. They paint the body and face of various colours, and consider the hair upon any part of it, except the head, as a deformity which they are careful to eradicate. Their limbs are generally slighter made than those of the Europeans; and, I am assured, they are far from being so strong. All these savages seem to be cowardly; they seldom are known to face their enemies in the field, but fall upon them at an advantage; and the greatness of their fears serves to increase the rigours of their cruelty. The wants which they often sustain, make them surprisingly patient in adversity: distress, by being grown familiar, becomes less terrible; so that their patience is less the result of fortitude than of custom. They have all a serious air, though tney seldom think; and, however cruel to their enemies, are kind and just to each other. In short, the customs of savage nations in every country are almost the same; a wild, independent, and precarious life, produces a peculiar train of virtues and vices: and patience and hospitality, indolence and rapacity, content and sincerity, are found not less among the natives of America, than all the barbarous nations of the globe.

The sixth and last variety of the human species, is that of the Europeans, and the nations bordering on them. In this class we may reckon the Georgians, Circassians, and Mingrelians, the inhabitants of Asia Minor, and the northern parts of Africa, together with a part of those countries which lie north-west of the Caspian sea. The inhabitants of these countries differ a good deal from each other; but they generally agree in the colour of their bodies, the beauty of their complexions, the largeness of their limbs, and the vigour of their understandings. Those arts which might have had their invention among the other races of mankind, have come to perfection there. In barbarous countries the inhabitants go either naked, or are awkwardly clothed in furs or feathers; in countries semi-barbarous, the robes are loose and flowing; but here the clothing is less made for show than expedition, and unites, as much as possible, the extremes of ornament and despatch.

To one or other of these classes we may refer the people of every country;[1] and as

---

quod sinum pudoris nuncupat. Attamen nihil differunt a nostratibus in hac parte nisi quod labia pudendæ sint aliquantulum tumidiora. In hominibus etiam penis est longior et multo laxior.

[1] It has been made a subject of dispute, whether there is more than one species in the human race; but it is merely a dispute of words; and if the term *species* is used in its common scientific sense, it cannot be denied that there is but one species. There are, however, certain and constant differences of stature, physiognomy, colour, nature of the hair, or form of the skull, which have given rise to subdivisions of this species. Blumenbach reduces these varieties to five:—

1. The first variety occupies the central parts of the old continent, namely, Western Asia, Eastern and Northern Africa, Hindoostan and Europe. Its characters are the colour of the skin, more or less white or brown; the cheeks tinged with red; long hair, either brown or fair; the head almost spherical; the face oval and narrow; the features moderately marked, the nose slightly arched; the mouth small; the front teeth placed perpendicularly in the jaws; the chin full and round. The regularity of the features of such a countenance, which is that of the European, causes it to be generally considered, by them at least, as the most agreeable. The Hindoos, the Abyssinians, the Brebers, or inhabitants of mount Atlas, have features not essentially differing from those of the Europeans, except in the colour of the skin, and which, among the Hindoo and Abyssinian mountaineers, is quite fair. Blumenbach calls this variety the *Caucasian*, from its supposed origin in the Caucasus. In plate VII., representations will be found of various tribes who belong to this variety. Fig. 1, is a Georgian: fig. 2, an Armenian; fig. 3, a Tscherkas-

each nation has been less visited by strangers, or has had less commerce with the rest of mankind, we find their persons and their manners more strongly impressed with one or other of the characters mentioned above. On the contrary, in those places where trade has long flourished, or where enemies have made many incursions, the races are usually found blended, and properly fall beneath no one character. Thus, in the islands of the Indian ocean, where a trade has been carried on for time immemorial, the inhabitants appear to be a mixture of all the nations upon the earth; white, olive, brown, and black men, are all seen living together in the same city, and propagating a mixed breed, that can be referred to none of the classes into which naturalists have thought proper to divide mankind.

Of all the colours by which mankind is diversified, it is easy to perceive, that ours is not only the most beautiful to the eye, but the most advantageous. The fair complexion seems, if I may so express it, as a transparent covering to the soul; all the variations of the passions, every expression of joy or sorrow, flows to the cheek, and, without language, marks the mind. In the slightest change of health also the colour of the European face is the most exact index, and often teaches us to prevent those disorders that we do not as yet perceive; not but that the African black, and the Asiatic olive complexions, admit of their alterations also; but these are neither so distinct, nor so visible, as with us; and in some countries the colour of the visage is never found to change; but the face continues in the same settled shade in shame and in sickness, in anger and despair.

The colour, therefore, most natural to man ought to be that which is most becoming; and it is found, that, in all regions, the children are born fair, or at least red, and that they grow more black, or tawny, as they advance in age. It should seem, consequently, that man is naturally white; since the same causes that darken the complexion in infants, may have originally operated, in slower degrees, in blackening whole nations. We could, therefore, readily account for the blackness of different nations, did we not see the Americans, who live under the line, as well as the natives of Negroland, of a red colour, and but a very small shade darker than the natives of the northern latitudes, in the same continent. For this reason, some have sought for other causes of blackness than the climate; and have endeavoured to prove that the blacks are a race of people bred from one man, who was marked

---

san; fig. 4, a Circassian; fig. 5, a Cabardiner; fig. 6, a Tschetschenzen; fig. 7, a Ccssack of the Don; fig. 8, a Cossack of the Ural; fig. 9, an Esthonian; fig. 10, a Moldavian; fig. 11, a Finn; fig. 12, an Arnaut; fig. 13, an Arabian; figs. 14 and 15, Mamelukes; fig. 16, a Copt.

2. The second variety has been called the *Eastern* variety. The colour in this race is yellow; the hair black, stiff, straight, and rather thin; the head almost square; the face large, flat, and depressed; the features indistinctly marked; the nose small and flat; the cheeks round and prominent; the chin pointed; the eyes small. This variety comprises the Asiatics to the east of the Ganges and of mount Beloor, except the Malays. Representations of this variety will be found in plates VII. and VIII. Plate VII., fig. 17, is a Turk; fig. 18, an Egyptian; fig. 19, a Persian; fig. 20, a Hindoo. Plate VIII., fig. 1, a Yakoute; fig. 2, an Ostiak; fig. 3, a Kalmuc; fig. 4, a Kirghises; fig. 5, a Kasanian; fig. 6, a Mongol; fig. 7, a Tomsk-Tatar; figs. 8, 9, and 10, Chinese; figs. 11 and 12, Japanese; figs. 13, 14, 15, and 16, Kamtschadale; fig. 17, inhabitants of Prince William's Sound; fig. 18, inhabitant of Nootka Sound.

3. The American variety resembles that last described in several points. Its principal characters are the copper-colour; stiff, thin, straight, black hair; low forehead; eyes sunk; the nose somewhat projecting; cheek-bones prominent; the face large. This variety comprises all the Americans except the Esquimaux. There are several branches, however, which differ considerably. The following are representations of this variety: fig. 19, plate VIII. represents Maxuruna, leader of one of the wild tribes on the frontiers of Peru. Fig. 20, same plate, represents Tajadaneega, general of the Mohawks. In plate IX., fig. 1, is represented a Samoyede; figs. 2, 3, 4, and 5, Brazilian Botokuden; fig. 6, a Brazilian Camakans; fig. 7, a Brazilian Puris, and fig. 8, a Brazilian Padachos.

4. The fourth variety of Blumenbach is called by him the *Malay*, and described as of a tawny colour; the hair black, soft, thick, and curled; the forehead a little projecting; the nose thick, wide, and flattened; the mouth large; the upper jaw projecting. This variety comprehends the islanders of the Pacific ocean. Representations of the Malay variety will be found in plate X. Figs. 5, *a*, *b*, and *c*, represent Papuas of New Holland · *a* was a Papua named Kour-Nou-Bari-Gat; *b*, Y-Erran-Gou-la-ga; *c*, Quire-kine. Fig. 6, represents Tatowirter, a warrior of Nukahiwa; fig. 7, an inhabitant of Fox island; figs. 8, and 9, New Zealanders; figs. 10, and 11, inhabitants of Oonalashka; figs. 12, and 13, inhabitants of the Sandwich islands; fig. 14, Tammeamea, prince of the Sandwich islands; fig. 15, Naba-Seba, prince of the Timor island; fig. 16, an Otaheitan.

5. The remaining variety is the Negro. Its characters are, colour black; hair black and woolly; head narrow; forehead convex and arched; cheek-bones projecting; nose large, and almost confounded with the upper jaw; the upper front teeth obliquely placed; the lips thick; the chin drawn in; the legs crooked. This race is found in Western and southern Africa, and the great islands of the Pacific, generally in the interior. There are very great differences in the tribes included in this variety: the Negro, with the complexion of jet, and wool; the Caffre, with a copper complexion, and long hair; the sooty Papous, or New Guineaman; the native of Van Diemen's Land; the Haraforas, who are found in Borneo, and the Hottentots, hardly differ more in situation than in features. Representations of this variety will be found in plates IX. and X. Figs. 1, 2, 3, and 4, in plate X., represent the Negro Proper. Figs. 9, 10, and 11, in plate IX., represent Hottentots. Figs. 12, 13, 14, 15, same plate, represent Bushmen, male and female. Fig. 16, same plate, *a*, *b*, *c*, represent Papuas of Van Diemen's Land, *a*, named Grou-Agara; *b*, Ara-Meida; and *c*, Para-Beri.

with accidental blackness. This, however, is but mere ungrounded conjecture: and, although the Americans are not so dark as the negroes, yet we must still continue in the ancient opinion, that the deepness of the colour proceeds from the excessive heat of the climate. For, if we compare the heats of Africa with those of America, we shall find they bear no proportion to each other. In America, all that part of the continent, which lies under the line, is cool and pleasant, either shaded by mountains, or refreshed by breezes from the sea. But in Africa, the wide tract of country that lies under the line is very extensive, and the soil sandy; the reflexion of the sun, therefore, from so large a surface of earth, is almost intolerable; and it is not to be wondered at, that the inhabitants should bear, in their looks, the marks of the inhospitable climate. In America, the country is but thinly inhabited; and the more torrid tracts are generally left desert by the inhabitants; for which reason they are not so deeply tinged by the beams of the sun. But in Africa the whole face of the country is fully peopled; and the natives are obliged to endure their situation, without a power of migration. It is there, consequently, that they are in a manner tied down to feel all the severity of the heat; and their complexions take the darkest hue they are capable of receiving. We need not, therefore, have recourse to any imaginary propagation, from persons accidentally black, since the climate is a cause obvious and sufficient to produce the effect.

In fact, if we examine the complexion of different countries, we shall find them darken in proportion to the heat of their climate; and the shades gradually to deepen as they approach the line. Some nations indeed, may be found not so much tinged by the sun as others, although they lie nearer the line. But this ever proceeds from some accidental causes; either from the country lying higher, and consequently being colder; or from the natives bathing oftener, and leading a more civilized life. In general, it may be asserted, that as we approach the line, we find the inhabitants of each country grow browner, until the colour deepens into perfect blackness. Thus, taking our standard from the whitest race of people, and beginning with our own country, which I believe, bids fairest for the pre-eminence, we shall find the French, who are more southern, a slight shade deeper than we; going farther down, the Spaniards are browner than the French; the inhabitants of Fez darker than they; and the natives of Negroland the darkest of all. In what manner the sun produces this effect, and how the same luminary which whitens wax and linen, should darken the human complexion, is not easy to conceive. Sir Thomas Brown first supposed, that a mucous substance, which had something of a vitriolic quality, settled under the reticular membrane, and grew darker with heat. Others have supposed that the blackness lay in the epidermis, or scarf-skin, which was burnt up like leather. But nothing has been satisfactorily discovered upon the subject; it is sufficient that we are assured of the fact; and that we have no doubt of the sun's tinging the complexion in proportion to its vicinity.[1]

---

[1] The colouring matter (we quote from the Supplement to the English translation of Cuvier's great work) is understood to reside in a membranous network of greater or less density extending over the surface of the body, called the rete mucosum. This is situated between the chorion or true skin and the cuticle. The rete mucosum, or, as it is sometimes called, the cutaneous reticle, consists of a fine texture of vessels, containing fluids of different shades in the black and tawny races. It seems, however, doubtful whether any such membrane for the deposition of colouring fluid exists in white men, though the varieties of fair and dark which we observe among them would seem to require some organization of this kind; nor does this theory sufficiently illustrate the occasional instances of pied or spotted men.

The human skin exhibits various shades of white, yellow, red, brown, and black. There is every possible intermediate shade between the fairest white and the deepest black, but no one gradation of colour is found in all the individuals of any nation. Generally speaking, however, we may refer all the national varieties of colour to the five following classes:—

1. White, accompanied with redness of cheeks. This characterizes all the Europeans except the Laplanders, the Western Asiatics, and the Northern Africans. Considerable variety will be found to exist in the colour generally called white. The albino possesses a skin of a reddish or a dead white colour, with yellowish white or milk-white hair, and red or very light coloured eyes. The hair over the whole body is unusually soft and white, not of the hoary colour of age, nor the light yellow or flaxen tint of the fair-haired races. It is rather that sort of colour peculiar to a white horse. These peculiarities evidently arise from a deficiency in the colouring principle, which is much the same in the skin, hair, and eyes. The latter organs are in the albinos peculiarly sensible to the stimulus of light, in consequence of the want of a black pigment, the office of which is to absorb its superfluous portions. Hence we find the eyelids of these people generally closed, and the eyes usually exhibiting some appearances of morbid phenomena. But in twilight, dusk, or even a close approach to darkness, they see remarkably well. This peculiarity exists from birth, never changes, and may be propagated by generation. Some would refer the albino variety to disease, but this notion appears incorrect, inasmuch as most of the individuals thus characterized are observed to be perfectly strong and healthy. This variety was first observed in the Africans, but it is far from being peculiar to that race. It has, however, never occurred except in detached instances, for though it is observed to be more prevalent in some parts of the world than others, the notion of entire albino tribes has been exploded. There is another race of men, with a remarkably fair complexion, yellow, flaxen, or red hair, and blue or gray eyes. In these persons the cutaneous capillaries are easily filled, and consequently they exhibit a general sanguineous tint, deeper and more florid in the face. The ancient and modern Germans belong to this variety, and generally

But we are not to suppose that the sun is the only cause of darkening the skin: the wind, extreme cold, hard labour, or coarse and sparing nourishment, are all found to contribute to this effect. We find the peasants of every country, who are most exposed to the weather, a shade darker than the higher ranks of people. The savage inhabitants of all places are exposed still more, and therefore contract a still deeper hue; and this will account for the tawny colour of the North American Indians. Although they live in a climate the same, or even more northerly than ours, yet they are found to be of complexions very different from those of Europe. But it must be considered, that they live continually exposed to the sun; that they use many methods to darken their skins by art, painting them with red ochre, and anointing them with the fat of bears. Had they taken, for a succession of several generations, the same precautions to brighten their colour that an European does, it is very probable that they would in time come to have similar complexions, and perhaps dispute the prize of beauty.

The extremity of cold is not less productive of a tawny complexion than that of heat. The natives of the arctic circle, as was observed, are all brown; and those that lie most to the north are almost entirely black. In this manner both extremes are unfavourable to the human form and colour, and the same effects are produced under the poles that are found at the line.

With regard to the stature of different countries, that seems chiefly to result from the nature of the food, and the quantity of the supply. Not but that the severity of heat or cold, may, in some measure. diminish the growth, and produce a dwarfishness of make. But, in general, the food is the great agent in producing this effect; where that is supplied in large quantities, and where its quality is wholesome and nutrimental, the inhabitants are generally seen above the ordinary stature. On the contrary, where it is afforded in a sparing quantity, or very coarse, and void of nourishment in its kind, the inhabitants degenerate, and sink below the ordinary size of mankind. In this respect they resemble other animals, whose bodies, by proper feeding, may be greatly augmented. An ox, on the fertile plains of India, grows to a size four times as large as the diminutive animal of the same kind bred in the Alps. The horses bred in the plains are larger than those of the mountain. So it is with man; the inhabitants of the valley are usually found taller than those of the hill: the natives of the Highlands of Scotland, for instance, are short, broad, and hardy; those of the Lowlands are tall and shapely. The inhabitants of Greenland, who live upon dried fish and seals, are less than those of Gambia, or Senegal, where nature supplies them with vegetable and animal abundance.

The form of the face seems rather to be the result of custom. Nations who have long considered some artificial deformity as beautiful, who have industriously lessened the feet or flattened the nose, by degrees begin to receive the impression they are taught to assume; and Nature, in a course of ages, shapes itself to the constraint, and assumes hereditary deformity. We find nothing more common in births, than for children to inherit some-

---

the Danes, Dutch, Swedes, English, &c. Lastly, a race very extensive is found with skin of a brownish white, and dark brown or black hair. The Southern Europeans and Western Asiatics are of this character.

2. The second grand variety in human colour is yellow or olive. This characterizes all the Mongolian tribes, and, generally speaking, most of the natives of Upper Asia.

3. Is the red or copper colour, which in various shades is prevalent over the centre American continent, and chiefly confined to it.

4. Brown or tawny. This in lighter or darker variations belongs to the inhabitants of the peninsula of Malacca, and is extended through most of the islands of the Pacific Ocean.

5. Black, in an amazing variety of shades, characterizes all the African continent, the northern and southern parts excepted, New Holland, Van Dieman's Land, New Guinea, New Hebrides, and some other islands of the South Sea. It is mingled with the ordinary colour of the natives in Brazil, California, and India.

It is not to be supposed that these different colours, thus generally described, prevail each of them uniformly in all the individuals of the race; on the contrary, there are considerable gradations, and even tribes have been found among the Americans, and individuals are constantly produced in each respective race with characteristics approaching to those of some other. Children born from an intermixture of different races hold generally a middle station between the two. Thus the Mulatto forms a medium between the African and the European. The colour will be more or less dark according to the complexion of the European father or mother. The cheeks are not ruddy, and the hair is black and curled, but less short than the negroes. The iris is always dark.

From the Europeans and Mulattoes proceed what are called Tercerons. These generally resemble Europeans. The hair has nothing of the woolly curl, the skin has a slight brown tint, and the cheeks are red. The offspring of these last and the Europeans are not to be distinguished from our own race. An opposite course will reduce the Mulatto offspring to the characters of the negro, and by intermixture with the latter, the fourth generation will be perfectly black. From the native Indians and the Europeans are born Mestizos. They are much lighter than the Mulattoes, and often not distinguishable in colour from Europeans. The small beard, hands, and feet, and the obliquity of the eyes, mark their Indian blood. The offspring from them and European fathers are in all respects like the Europeans. From Negroes and Americans spring Zambos, resembling Mulattoes, but darker. Among the dark races are sometimes found persons spotted with white.

times even the accidental deformities of their parents. We have many instances of squinting in the father, which he received from fright or habit, communicated to the offspring; and I myself have seen a child distinctly marked with a scar, similar to one the father had received in battle. In this manner, accidental deformities may become natural ones; and by assiduity may be continued, and even increased, through successive generations. From this, therefore, may have arisen the small eyes and long ears of the Tartar and Chinese nations. From hence originally may have come the flat noses of the blacks, and the flat heads of the American Indians.[1]

In this slight survey, therefore, I think we may see that all the variations in the human figure, as far as they differ from our own, are produced either by the rigour of the climate, the bad quality or the scantiness of the provisions, or by the savage customs of the country. They are actual marks of the degeneracy in the human form; and we may consider the European figure and colour as standards to which to refer all other varieties, and with which to compare them. In proportion as the Tartar or American approaches nearer to European beauty, we consider the race as less degenerated; in proportion as he differs more widely, he has made greater deviations from his original form.

That we have all sprung from one common parent, we are taught both by reason and religion, to believe; and we have good reason also to think that the Europeans resemble him more than any of the rest of his children. However, it must not be concealed that the olive-coloured Asiatic, and even the jet-black negro, claim this honour of hereditary resemblance; and assert that white men are mere deviations from original perfection. Odd as this opinion may seem, they have Linnæus, the celebrated naturalist, on their side; who supposes man a native of the tropical climates, and only a sojourner more to the north. But not to enter into a controversy upon a matter of a very remote speculation, I think one argument alone will suffice to prove the contrary, and show that the white man is the original source from whence the other varieties have sprung. We have frequently seen white children produced from black parents, but have never seen a black offspring the production of two whites. From hence we may conclude, that whiteness is the colour to which mankind naturally tends: for, as in the tulip, the parent stock is known by all the artificial varieties breaking into it; so in man, that colour must be original which never alters, and to which all the rest are accidentally seen to change. I have seen in London, at different times, two white negroes the issue of black parents, that served to convince me of the truth of this theory. I had before been taught to believe that the whiteness of the negro's skin was a disease, a kind of milky whiteness, that might be called rather a leprous crust than a natural complexion. I was taught to suppose that the numberless white negroes found in various parts of Africa, the white men that go by the name of Chacrelas, in the East Indies, and the white Americans, near the Isthmus of Darien, in the West Indies, were all as so many diseased persons, and even more deformed than the blackest of the natives. But, upon examining that negro which was last shown in London, I found the colour to be exactly like that of an European: the visage white and ruddy, and the lips of the proper redness. However, there were sufficient marks to convince me of its descent. The hair was white and woolly, and very unlike any thing I had seen before. The iris of the eye was yellow, inclining to red; the nose was flat, exactly resembling that of a negro: and the lips thick and prominent. No doubt, therefore, remained of the child's having been born of negro parents: and the person who showed it had attestations to convince the most incredulous. From this, then, we see that the variations of the negro colour is into whiteness, whereas the white are never found to have a race of negro children. Upon the whole, therefore, all those changes which the African, the Asiatic, or the American, undergo, are but accidental deformities, which a kinder climate, better nourishment, or more civilized manners, would in a course of centuries, very probably remove.

---

[1] In Plate XI. we have given representations of the craniums of the different varieties of the human race.

Variety I. The Caucasian, pl. XI. fig. 1., fig. 2. coronal surface of the skull. Face oval; facial angle 85 degrees; forehead high, expanded; space between the eyes wide, cheeks coloured with red, hair long, usually of a brown colour. This form predominates in Europe. To which also belong the ancient Greeks; as exhibited in the skull fig. 6, where the forehead rises to a great height.

Variety II. The Mongolian, fig. 3. Face flat, broad, copper coloured, with lateral projections of the cheek bones; facial angle 75 degrees; space between the eyes narrow, eyes placed somewhat obliquely; hair straight, hard; lips thick; nose somewhat depressed; beard thin. This race is spread over Asia, Finland, European Lapland, and includes the Esquimaux hordes.

Variety III. The American, fig. 32. Forehead short; cheek bones prominent; nose flattish; facial angle 73 degrees; skin mostly tan, varying to reddish copper-colour; hair straight and coarse, beard thin. This variety comprises the whole aborigines of America, with the exception of the Esquimaux. This skull is that of a North American Indian. Fig. 46 is the skull of a Carib, it represents the most preponderating of the lower lateral and posterior portions of the brain, of any variety of skull known to exist.

Variety IV. The Malayan, fig. 33. Face of an obtuse oval; nose broad; mouth wide; facial angle 73 degrees; skin varying in colour from mahogany to chestnut and clove brown. This race inhabits India, near the Ganges, with the islands of the Indian ocean and Polynesia. The skull is that of a Siamese.

Variety V. The Ethiopian, fig. 4. Face round, the upper and lower jaw projecting forward considerably; nose flat, broad; lips very thick; facial angle 70 degrees, skin brownish-black, of different degrees of intensity; hair woolly, frizzled and black. This race inhabits the middle parts of Africa. Fig. 5 represents the coronal surface of the skull.

CHAP. XII.

OF MONSTERS.

Hitherto I have only spoken of those varieties in the human species, that are common to whole nations: but there are varieties of another kind, which are only found in the individual, and being more rarely seen, are therefore called *monstrous*. If we examine into the varieties of distorted nature, there is scarcely a limb of the body, or a feature in the face, that has not suffered some reprobation, either from art or nature; being enlarged or diminished, lengthened or wrested, from its due proportion. Linnæus, after having given a catalogue of monsters, particularly adds, the flat heads of Canada, the long heads of the Chinese, and the slender waists of the women of Europe, who, by strait lacing, take such pains to destroy their health, through a mistaken desire to improve their beauty.[1] It belongs more to the physician than the naturalist to attend to these minute deformities; and indeed it is a melancholy contemplation to speculate upon a catalogue of calamities, inflicted by unpitying nature, or brought upon us by our own caprice. Some, however, are fond of such accounts: and there have been books filled with nothing else. To these, therefore, I refer the reader; who may be better pleased with accounts of men with two heads, or without any head, of children joined in the middle, of bones turned into flesh, or flesh converted into bones, than I am.[2] It is sufficient here to observe, that every day's experience must have shown us miserable instances of this kind produced by nature or affectation; calamities that no pity can soften, or assiduity relieve.[3]

---

[1] Linnæi Syst. vol. i. p. 29. Monorchides ut minus fertiles.

[2] Vide Phil. Trans. passim, Miscellan. Curioss. Johan. Baptist. Wenck. Dissertatio Physica an ex virilis humani seminis cum brutali per nefarium coitum commixtione, aut vicissim ex bruti maris cum muliebri humano seminis commixtione possit verus homo generari. Vide etiam, Johnstoni Thaumatographia Naturalis. Vide Adalberti Disquisitio Physica ostenti duorum puerorum, unus quorum dente aureo, alter cum capite giganteo Biluæ spectabatur. A man without lungs and stomach, Journal de Savans, 1682, p. 301; another without any brain, Andreas Caroli Memorabilia, p. 166, an. 1776; another without any head, Giornale di Roma, anno 1675, p. 26; another without any arms, New Memoirs of Literature, vol. iv. p. 446. In short, the variety of these accounts is almost infinite; and perhaps, their use is as much circumscribed as their variety is extensive. *Note by Goldsmith.*

[3] Every one knows how much parents influence the product of generation. The vital power, for example, the duration of life, the temperament, form, degenerescences, and numerous other diseases, are hereditary. These are the vicious contrarieties of the power of life. The Jews and Mussulmans are circumcised for ages; but their progeny are born with a prepuce. Frogs and salamanders engender tadpoles with projections which they do not possess. The diseases which are transmitted by generation, are the constitutional affections of the body, and not local diseases; a deaf, blind, humpbacked, or deformed individual, rarely communicates his infirmity to his descendants; but epileptics, hypochondriacs, the gouty or calculous (those labouring under gravel or stone) perpetuate their diseases to their families. It is also the same as to the strong or feeble constitution of parents. Animals born of aged parents are feeble and languid, because they received a life enfeebled and exhausted. We rarely observe these facts in vegetables. There is also a resemblance between infants and parents, in their temperaments and hereditary characters, but these resemblances are most marked in proportion as love and the vigour of the generative power have been more considerable; and as the inferior animals follow nature better than men, their productions are more like themselves than infants are their parents. It is not, then, astonishing that mankind often form vicious and disfigured productions; besides, the irregularities of life, the passions, effeminacy, feebleness, diseases of pregnancy, have great influence on the offspring. Domestic animals, which enjoy a kind of life so opposed to the natural state, are equally subject to irregularities in generation. Monsters or monstrosities are more common, for this reason, in the human species and in domestic animals, than among the species which live according to the laws of nature. The weakness of the seeds, the effects of the abuse of amorous pleasures, cause imperfect infants, false germs, as moles or false conceptions, which are irregular fleshy masses, ordinarily containing the rudiments of the organs and limbs, which remain in the womb for a long time and harden. In fact, nature cannot engender more than imperfect infants, on account of want of time sufficient for the elaboration of the seeds; she endeavours, nevertheless, to perfect them, to give them life, and employs a longer time than in ordinary pregnancies, for moles have continued during the whole life of the woman who conceived them. Females who have borne moles or monstrosities sometimes preserve the power to reproduce them, by a habitude which their organs have contracted. Individuals who fear dishonour, which does not always defend them from seduction, produce moles; or, when chagrin and the secret desire to abort enfeeble the effect of impregnation.

There are many kinds of monsters where the organs are in excess, as infants with two heads, four arms, &c., or where the organs are defective, as infants without legs, arms, &c., or where there is a transposition of organs, or by alterations of forms. When two embryos are developed at the same time in the womb, they may grow together or be partially or wholly united; they may be, moreover, less imperfect; and the same thing is ob-

Passing over, therefore, every other account, I shall only mention the famous instance quoted by Father Malbranche upon which he founds his beautiful theory of monstrous productions. A woman of Paris, the wife of a tradesman, went to see a criminal broke alive upon the wheel, at the place of public execution. She was at that time two months advanced in her pregnancy, and no way subject to any disorders to affect the child in her womb. She was, however, of a tender habit of body; and, though led by curiosity to this horrid spectacle, very easily moved to pity and compassion. She felt, therefore, all those strong emotions which so terrible a sight must naturally inspire; shuddered at every blow the criminal received, and almost swooned at his cries. Upon returning from this scene of blood, she continued for some days pensive, and her imagination still wrought upon the spectacle she had lately seen. After some time, however, she seemed perfectly recovered from her fright, and had almost forgotten her former uneasiness. When the time of her delivery approached, she seemed no ways mindful of her former terrors, nor were her pains in labour more than usual in such circumstances. But what was the amazement of her friends and assistants when the child came into the world! It was found that every limb in its body was broken like those of the malefactor, and just in the same place. This poor infant that had suffered the pains of life even before its coming into the world, did not die, but lived in an hospital in Paris, for twenty years after, a wretched instance of the supposed powers of imagination in the mother, of altering and distorting the infant in the womb. The manner in which Malbranche reasons upon this fact, is as follows: the Creator has established such a sympathy between the several parts of nature, that we are led not only to imitate each other, but also to partake in the same affections and desires. The animal spirits are thus carried to the respective parts of the body, to perform the same actions which we see others perform, to receive in some measure their wounds, and take part in their sufferings. Experience tells us, that if we look attentively on any person severely beaten, or sorely wounded, the spirits immediately flow into those parts of the body which correspond to those we see in pain. The more delicate the constitution, the more it is thus affected; the spirits making a stronger impression on the fibres of a weakly habit than of a robust one. Strong vigorous men see an execution without much concern, while women of nicer texture are struck with horror and concern. This sensibility in them must, of consequence, be communicated to all parts of their body; and as the fibres of the child in the womb are incomparably finer than those of the mother, the course of the animal spirits must consequently produce greater alterations. Hence every stroke given to the criminal forcibly struck the imagination of the woman; and by a kind of counter-stroke, the delicate tender frame of the child.

Such is the reasoning of an ingenious man upon a fact, the veracity of which many have since called in question.[1] They have allowed, indeed, that such a child might have been produced, but have denied the cause of its deformity. "How could the imagination of the mother," say they, "produce such dreadful effects upon her child? She has no communication with the infant; she scarcely touches it in any part; quite unaffected with her concerns it sleeps in security, in a manner secluded by a fluid in which it swims, from her that bears it. With what a variety of deformities," say they, "would all mankind be marked, if all the vain and capricious desires of the mother were thus readily written upon the body of the child!" Yet notwithstanding this plausible way of reasoning, I cannot avoid giving some credit to the variety of instances I have either read or seen upon this subject. If it be a prejudice, it is as old as the days of Aristotle, and to this day as strongly believed by the generality of mankind as ever. It does not admit of a reason; and, indeed, I can give none, even why the child should, in any respect, resemble the father or the mother. The fact we generally find to be so. But why it should take the particular print of the father's features in the womb is as hard to conceive, as why it should be affected by the mother's imagination. We all know what a strong effect the imagination has on these parts in particular, without being able to assign a cause how this effect is produced; and why the imagination may not produce the same effect in marking the child that it does in forming it, I see no reason. Those persons whose employment it is to rear up pigeons of different

---

served in eggs containing two yolks, which produce chickens with double feet, &c., and the same is seen in vegetables and animals which have several young ones, and these are more liable to have monsters than those that bring forth but one little one.

M. Virey is of opinion that tight lacing and strong passions contribute to the deformity of infants. Peasants who are robust generally engender well-formed infants, because they follow nature more closely than the delicate women of large cities. In proportion as we deviate from nature, we obtain products less natural and more deformed.

In the ages of superstitions, the birth of a monstrous infant, was considered a proof of sexual connexion with an evil spirit, or a sign of celestial vengeance, and the burning of the mother, could alone expiate so great a crime in the eyes of the people.—*Lon. Med. and Sur. Jour.*

[1] Buffon, vol. iv. p. 9.

colours, can breed them, as their expression is, to a feather. In fact, by properly pairing them, they can give what colour they will to any feather, in any part of the body. Were we to reason upon this fact, what could we say? Might it not be asserted, that the egg, being distinct from the body of the female, cannot be influenced by it? Might it not be plausibly said, that there is no similitude between any part of the egg and any particular feather which we expect to propagate; and yet for all this the fact is known to be true, and what no speculation can invalidate. In the same manner, a thousand various instances assure us that the child in the womb is sometimes marked by the strong affections of the mother: how this is performed we know not; we only see the effect, without any connection between it and the cause. The best physicians have allowed it; and have been satisfied to submit to the experience of a number of ages; but many disbelieve it, because they expect a reason for every effect. This, however, is very hard to be given, while it is very easy to appear wise by pretending incredulity.

Among the number of monsters, dwarfs and giants are usually reckoned; though not, perhaps, with the strictest propriety, since they are no way different from the rest of mankind, except in stature. It is a dispute, however, about words; and therefore scarcely worth contending about. But there is a dispute, of a more curious nature, on this subject; namely, whether there are races of people thus very diminutive, or vastly large; or whether they be merely accidental varieties, that now and then are seen in a country, in a few persons, whose bodies some external cause has contributed to lessen or enlarge.

With regard to men of diminutive stature, all antiquity has been unanimous in asserting their national existence. Homer was the first who has given us an account of the pigmy nation contending with the cranes; and what poetical license might be supposed to exaggerate, Athenæus has attempted seriously to confirm by historical assertion.[1] If we attend to these, we must believe that, in the internal parts of Africa, there are whole nations of pigmy beings, not more than a foot in stature, who continually wage an unequal war with the birds and beasts that inhabit the plains in which they reside. Some of the ancients, however, and Strabo in particular, have supposed all these accounts to be fabulous; and have been more inclined to think this supposed nation of pigmies nothing more than a species of apes, well known to be numerous in that part of the world. With this opinion the moderns have all concurred; and that diminutive race, which was described as human, has been long degraded into a class of animals that resemble us but very imperfectly.

The existence, therefore, of a pigmy race of mankind being founded in error, or in fable, we can expect to find men of diminutive stature only by accident, among men of the ordinary size. Of these accidental dwarfs, every country, and almost every village, can produce numerous instances. There was a time when these unfavoured children of Nature were the peculiar favourites of the great; and no prince or nobleman thought himself completely attended unless he had a dwarf among the number of his domestics. These poor little men were kept to be laughed at; or to raise the barbarous pleasure of their masters, by their contrasted inferiority. Even in England, as late as the times of King James I. the court was at one time furnished with a dwarf, a giant, and a jester; these the king often took a pleasure in opposing to each other, and often fomented quarrels among them, in order to be a concealed spectator of their animosity. It was a particular entertainment of the courtiers at that time to see little Jeffrey, for so the dwarf was called, ride round the lists, expecting his antagonist; and discovering in his actions, all the marks of contemptible resolution.

It was in the same spirit, that Peter of Russia, in the year 1710, celebrated a marriage of dwarfs. This monarch, though raised by his native genius far above a barbarian, was, nevertheless, still many degrees removed from actual refinement. His pleasures, therefore, were of the vulgar kind; and this was among the number. Upon a certain day, which he had ordered to be proclaimed several months before, he invited the whole body of his courtiers, and all the foreign ambassadors, to be present at the marriage of a pigmy man and woman. The preparations for this wedding were not only very grand, but executed in a style of barbarous ridicule. He ordered that all the dwarf men and women, within two hundred miles, should repair to the capital; and also insisted that they should be present at the ceremony. For this purpose he supplied them with proper vehicles; but so contrived it, that one horse was seen carrying in a dozen of them into the city at once, while the mob followed shouting and laughing, from behind. Some of them were at first unwilling to obey an order which they knew was calculated to turn them into ridicule, and did not come; but he soon obliged them to obey: and, as a punishment, enjoined, that they should wait upon the rest at dinner. The whole company of dwarfs amounted to seventy, besides the bride and bridegroom, who were richly adorned, and in the extremity of the fashion. For this little company in miniature, every thing was suitably provided; a low table, small plates, little glasses, and, in short, every thing was so fitted as if all things had been dwindled to their own standard. It was his great pleasure to see their gravity and their pride; the contention of the women for places and the men for superiority. This point he attempted to adjust, by ordering that the most diminutive should take the lead; but this bred disputes, for none would then consent to sit foremost. All this, however, being at last settled, dancing followed the dinner, and the ball was opened with a minuet by the bridegroom, who measured exactly three feet two inches high. In the end, matters were so contrived, that this little company, who met together in gloomy pride, and unwilling to be pleased, being at last familiarized to laughter, joined in the diversion, and became, as the journalist has it, extremely sprightly and entertaining.[1]

---

[1] Athenæus. ix. 390.

But whatever may be the entertainment such guests might afford when united, I never found a dwarf capable of affording any when alone. I have sometimes conversed with some of these that were exhibited at our fairs about town, and have ever found their intellects as contracted as their persons. They in general seemed to me to have faculties very much resembling those of children, and their desires likewise of the same kind; being diverted with the same sports, and best pleased with such companions. Of all those I have seen, which may amount to five or six, the little man, whose name was Coan, that died lately at Chelsea, was the most intelligent and sprightly. I have heard him and the giant, who sung at the theatres, sustain a very ridiculous duet, to which they were taught to give great spirit. But this mirth, and seeming sagacity, were but assumed. He had, by long habit, been taught to look cheerful upon the approach of company; and his conversation was but the mere etiquette of a person that had been used to receive visitors. When driven out of his walk, nothing could be more stupid or ignorant, nothing more dejected or forlorn. But we have a complete history of a dwarf, very accurately related by Mr Daubenton, in his part of the Histoire Naturelle; which I will here take leave to translate.

This dwarf, whose name was Baby, was well known, having spent the greatest part of his life at Lunenville in the palace of Stanislaus, the titular king of Poland. He was born near the village of Plaisne, in France, in the year 1741. His father and mother were peasants, both of good constitutions, and inured to a life of husbandry and labour. Baby, when born, weighed but a pound and a quarter. We are not informed of the dimensions of his body at that time; but we may conjecture they were very small, as he was presented on a plate to be baptized, and for a long time lay in a slipper. His mouth, although proportioned to the rest of his body, was not, at that time, large enough to take in the nipple; and he was therefore, obliged to be suckled by a she-goat that was in the house; and that served as a nurse, attending to his cries with a kind of maternal fondness. He began to articulate some words when eighteen months old; and at two years he was able to walk alone. He was then fitted with shoes that were about an inch and a half long. He was attacked with several acute disorders; but the small-pox was the only one which left any marks behind it. Until he was six years old, he eat no other food but pulse, potatoes, and bacon. His father and mother were, from their poverty, incapable of affording him any better nourishment; and his education was little better than his food, being bred up among the rustics of the place. At six years old he was about fifteen inches high; and his whole body weighed but thirteen pounds. Notwithstanding this, he was well-proportioned and handsome; his health was good, but his understanding scarcely passed the bounds of instinct. It was at that time that the king of Poland, having heard of such a curiosity, had him conveyed to Lunenville, gave him the name of *Baby*, and kept him in his palace.

Baby, having thus quitted the hard condition of a peasant, to enjoy all the comforts and conveniences of life, seemed to receive no alteration from his new way of living, either in mind or person. He preserved the goodness of his constitution till about the age of sixteen, but his body seemed to increase very slowly during the whole time; and his stupidity was such, that all instructions were lost in improving his understanding. He could never be brought to have any sense of religion, nor even to show the least signs of a reasoning faculty. They attempted to teach him dancing and music, but in vain; he never could make any thing of music; and as for dancing, although he beat time tolerably exact, yet he could never remember the figure, but while his dancing-master stood by to direct his motions. Notwithstanding, a mind thus destitute of understanding was not without its passions; anger and jealousy harassed it at times; nor was he without desires of another nature.

At the age of sixteen, Baby was twenty-nine inches tall; at this he rested; but having thus arrived at his acme, the alterations of puberty, or rather, perhaps, of old age, came fast upon him. From being very beautiful, the poor little creature now became quite deformed; his strength quite forsook him; his back-bone began to bend; his head hung forward; his legs grew weak; one of his shoulders turned awry; and his nose grew disproportionably large. With his strength, his natural spirits also forsook him; and, by the time he was twenty, he was grown feeble, decrepit, and marked with the strongest impressions of old age. It had been before remarked by some, that he would die of old age before he arrived at thirty; and, in fact, by the time he was twenty-two, he could scarcely walk a hundred paces, being worn out with the multiplicity of his years, and bent under the burden of protracted life. In this year he died; a cold attended with a slight fever, threw him into a kind of lethargy, which had a few momentary intervals; but he could scarcely be brought to speak. However, it is asserted, that in the five last years in his life, he showed a clearer understanding than in his times of best health: but at length he died, after enduring great agonies, in the twenty-second year of his age.

---

[1] Die dench wurdige. Iwerg. Hockweit, &c. Lipsæ, 1713, vol. viii. p. 102. seq.

Opposite to this accidental diminution of the human race, is that of its extraordinary magnitude. Concerning the reality of a nation of giants, there have been many disputes among the learned. Some have affirmed the probability of such a race; and others, as warmly have denied the possibility of their existence. But it is not from any speculative reasonings, upon a subject of this kind, that information is to be obtained; it is not from the disputes of the scholar, but the labours of the enterprising, that we are to be instructed in this inquiry. Indeed, nothing can be more absurd, than what some learned men have advanced upon this subject. It is very unlikely, says Grew, that there should either be dwarfs or giants; or if such, they cannot be fitted for the usual enjoyment of life and reason. Had man been born a dwarf, he could not have been a reasonable creature: for to that end, he must have a jolt head, and then he would not have body and blood enough to supply his brain with spirits; or if he had a small head, proportionable to his body, there would not be brain enough for conducting life. But it is still worse with giants; and there could never have been a nation of such, for there would not be food enough found in any country to sustain them; or if there were beasts sufficient for this purpose, there would not be grass enough for their maintenance. But what is still more, add others, giants could never be able to support the weight of their own bodies; since a man of ten feet high, must be eight times as heavy as one of the ordinary stature; whereas he has but twice the size of muscles to support such a burden: and, consequently, would be overloaded with the weight of his own body. Such are the theories upon this subject; and they require no other answer, but that experience proves them both to be false: dwarfs are found capable of life and reason; and giants are seen to carry their own bodies. We have seen several accounts from mariners, that a nation of giants actually exists; and mere speculation should never induce us to doubt their veracity.

Ferdinand Magellan was the first who discovered this race of people along the coast towards the extremity of South America. Magellan was a Portuguese, of noble extraction; who having long behaved with great bravery, under Albuquerque, the conqueror of India, he was treated with neglect by the court, upon his return. Applying, therefore, to the king of Spain, he was intrusted with the command of five ships, to subdue the Molucca islands; upon one of which he was slain. It was in his voyage thither, that he happened to winter in St Julian's Bay, an American harbour, forty-nine degrees south of the line. In this desolate region, where nothing was seen but objects of terror, where neither trees nor verdure dressed the face of the country, they remained for some months without seeing any human creature. They had judged the country to be utterly uninhabitable; when one day they saw approaching, as if he had been dropped from the clouds, a man of enormous stature, dancing and singing, and putting dust upon his head, as they supposed, in token of peace. This overture for friendship was, by Magellan's command, quickly answered by the rest of his men; and the giant approaching, testified every mark of astonishment and surprise. He was so tall, that the Spaniards only reached his waist; his face was broad, his colour brown, and painted over with a variety of tints; each cheek had the resemblance of a heart drawn upon it; his hair was approaching to whiteness; he was clothed in skins, and armed with a bow. Being treated with kindness, and dismissed with some trifling presents, he soon returned with many more of the same stature; two of whom the mariners decoyed on ship-board; nothing could be more gentle than they were in the beginning; they considered the fetters that were preparing for them as ornaments, and played with them like children with their toys; but when they found for what purpose they were intended, they instantly exerted their amazing strength, and broke them in pieces with a very easy effort. This account, with a variety of other circumstances, has been confirmed by succeeding travellers: Herrara, Sebald Wert, Oliver Van Noort, and James le Maire, all corresponding in affirming the fact, although they differ in many particulars of their respective descriptions. The last voyager we have had, that has seen this enormous race, is Commodore Byron. I have talked with the person who first gave the relation of that voyage, and who was the carpenter of the commodore's ship; he was a sensible, understanding man, and I believe extremely faithful. By him, therefore, I was assured, in the most solemn manner, of the truth of his relation; and this account has since been confirmed by one or two publications; in all which the particulars are pretty nearly the same. One of the circumstances which most puzzled me to reconcile to probability was that of the horses, on which they are described as riding down to the shore. We know the American horse to be of the European breed; and, in some measure, to be degenerated from the original. I was at a loss, therefore, to account how a horse of not more than fourteen hands high, was capable of carrying a man of nine feet; or, in other words, an animal almost as large as itself. But the wonder will cease, when we consider, that so small a beast as an ass, will carry a man of ordinary size tolerably well; and the proportion between this and the former instance is nearly exact. We can no longer, therefore, refuse our assent to the existence of this gigantic race of mankind: in what manner they are propagated, or under what regulations they live, is a subject that remains for future investigation. It should appear, however, that they are a wandering nation, changing their abode with the course of the sun, and shifting their situation, for the convenience of food, climate, or pasture.[1]

This race of giants are described as possessed of great strength; and, no doubt, they must be very different from those accidental giants that are to be seen in different parts of Europe. Stature, with these, seems rather their infirmity than their pride; and adds to their burden, without increasing their strength. Of those I have seen, the generality were ill formed and unhealthful; weak in their persons, or incapable of exerting what strength they were possessed of. The same defects of understanding that attended those of suppressed stature, were found in those who were thus overgrown: they were heavy, phlegmatic, stupid, and inclined to sadness. Their numbers, however, are but few; and it is thus kindly ordered by Providence, that as the middle stature is the best fitted for happiness, so the middle ranks of mankind are produced in the greatest variety.

However, mankind seems naturally to have a respect for men of extraordinary stature; and it has been a supposition of long standing, that our ancestors were much taller, as well as much more beautiful, than we. This has been, indeed, a theme of poetical declamation from the beginning; and man was scarcely formed, when he began to deplore an imaginary decay. Nothing is more natural than this progress of the mind, in looking up to antiquity with reverential wonder. Having been accustomed to compare the wisdom of our fathers with our own in early imbecility, the impression of their superiority remains when they no longer exist, and when we cease to be inferior. Thus the men of every age consider the past as wiser than the present; and the reverence seems to accumulate as our imaginations ascend. For this reason, we allow remote antiquity many advantages, without disputing their title; the inhabitants of uncivilized countries represent them as taller and stronger; and the people of a more polished nation, as more healthy and more wise. Nevertheless, these attributes seem to be only the prejudices of ingenuous minds; a kind of gratitude, which we hope in turn to receive from posterity. The ordinary stature of men, Mr Derham observes, is, in all probability, the same now as at the beginning. The oldest measure we have of the human figure, is in the monument of Cheops, in the first pyramid of Egypt. This must have subsisted many hundred years before the times of Homer, who is the first that deplores the decay. This monument, however, scarcely exceeds the measure of our ordinary coffins: the cavity is no more than six feet long, two feet wide, and deep in about the same proportion. Several mummies also, of a very early age, are found to be only of the ordinary stature; and show that, for these three thousand years at least, men have not suffered the least diminution. We have many corroborating proofs of this, in the ancient pieces of armour which are dug up in different parts of Europe. The brass helmet dug up at Medauro, fits one of our men, and yet is allowed to have been left there at the overthrow of Asdrubal. Some of our finest antique statues, which we learn from Pliny and others to be exactly as big as the life, still continue to this day, remaining monuments of the superior excellence of their workmen indeed, but not of the superiority of their stature. We may conclude, therefore, that men have been in all ages pretty much of the same size they are at present; and that the only difference must have been accidental, or perhaps national.

As to the superior beauty of our ancestors, it is not easy to make the comparison: beauty seems a very uncertain charm; and frequently is less in the object, than in the eye of the beholder. Were a modern lady's face formed exactly like the Venus of Medicis, or the Sleeping Vestal, she would scarcely be considered beautiful, except by the lovers of antiquity, whom of all her admirers perhaps she would be least desirous of pleasing. It is true, that we have some disorders among us that disfigure the features, and from which the ancients were exempt; but it is equally true, that we want some which were common among them, and which were equally deforming. As for their intellectual powers, these also were probably the same as ours: we excel them in the sciences, which may be considered as a history of accumulated experience; and they excel us in the poetic arts, as they had the first rifling of all the striking images of Nature.

---

[1] Later voyagers have not confirmed this account, in some particulars.—*Note by Goldsmith.*

CHAP. XIII.

OF MUMMIES, WAX-WORK, ETC.

"Man[1] is not content with the usual term of life, but he is willing to lengthen out his existence by art; and although he cannot prevent death, he tries to obviate his dissolution. It is natural to attempt to preserve even the most trifling relics of what has long given us pleasure; nor does the mind separate from the body, without a wish, that even the wretched heap of dust it leaves behind may yet be remembered. The embalming practised in various nations, probably had its rise in this fond desire: an urn filled with ashes, among the Romans, served as a pledge of continuing affection; and even the grassy graves in our own church-yards are raised above the surface, with the desire that the body below should not be wholly forgotten. The soul, ardent after eternity for itself, is willing to procure, even for the body, a prolonged duration."

But of all nations, the Egyptians carried this art to the highest perfection: as it was a principle of their religion, to suppose the soul continued only coeval to the duration of the body, they tried every art to extend the life of the one by preventing the dissolution of the other. In this practice they were exercised from the earliest ages; and the mummies they have embalmed in this manner, continue in great numbers to the present day. We are told, in Genesis, that Joseph, seeing his father expire, gave orders to his physicians to embalm the body, which they executed in the compass of forty days, the usual time of embalming. Herodotus also, the most ancient of the profane historians, gives us a copious detail of this art, as it was practised, in his time, among the Egyptians. There are certain men among them, says he, who practise embalming as a trade; which they perform with all expedition possible. In the first place, they draw out the brain through the nostrils, with irons adopted to this purpose; and in proportion as they evacuate it in this manner, they fill up the cavity with aromatics: they next cut open the belly near the sides with a sharpened stone, and take out the entrails, which they cleanse, and wash in palm oil; having performed this operation, they roll them in aromatic powder, fill them with myrrh, cassia, and other perfumes, except incense; and replace them, sewing up the body again. After these precautions, they salt the body with nitre, and keep it in the salting place for seventy days, it not being permitted to preserve it so any longer. When the seventy days are accomplished, and the body washed once more, they swathe it in bands made of linen, which have been dipt in a gum the Egyptians use instead of salt. When the friends have taken back the body, they make a hollow trough, something like the shape of a man, in which they place the body; and this they inclose in a box, preserving the whole as a most precious relic, placed against the wall. Such are the ceremonies used with regard to the rich. As for those who are contented with an humbler preparation, they treat them as follows: they fill a syringe with an odoriferous liquor extracted from the cedar-tree, and without making any incision, inject it up the body of the deceased, and then keep it in nitre, as long as in the former case. When the time is expired, they evacuate the body of the cedar liquor which had been injected; and such is the effect of this operation, that the liquor dissolves the intestines, and brings them away: the nitre also serves to eat away the flesh, and leaves only the skin and the bones remaining. This done, the body is returned to the friends, and the embalmer takes no farther trouble about it. The third method of embalming those of the meanest condition is merely by purging and cleansing the intestines by frequent injections, and preserving the body for a similar term in nitre, at the end of which it is restored to the relations.

Diodorus Siculus also makes mention of the manner in which these embalmings are performed. According to him, there were several officers appointed for this purpose; the first of them, who was called the scribe, marked those parts of the body on the left side which were to be opened; the cutter made the incision; and one of those that were to salt it drew out all the bowels, except, the heart, and the kidneys; another washed them in palm wine and odoriferous liquors; afterwards they anointed for above thirty days with cedar, gum, myrrh, cinnamon, and other perfumes. These aromatics preserved the body entire for a long time, and gave a very agreeable odour. It was not in the least disfigured by this preparation; after which it was returned to the relations, who kept it in a coffin, placed upright against a wall.

---

[1] This chapter I have, in a great measure, translated from Mr Daubenton. Whatever is added from others, is marked with inverted commas.—*Note by Goldsmith.*

Most of the modern writers who have treated on this subject, have merely repeated what has been said by Herodotus; and if they add any thing of their own, it is but merely from conjecture. Dumont observes that it is very probable, that aloes, bitumen, and cinnamon, make a principal part of the composition which is used on this occasion: he adds, that, after embalming, the body is put into a coffin, made of the sycamore tree, which is almost incorruptible. Mr Grew remarks, that in an Egyptian mummy, in the possession of the Royal Society, the preparation was so penetrating as to enter into the very substance of the bones, and rendered them so black that they seem to have been burned. From this he is induced to believe that the Egyptians had a custom of embalming their dead, by boiling them in a kind of liquid preparation, until all the aqueous parts of the body were exhaled away; and until the oily or gummy matter had penetrated throughout. He proposes, in consequence of this, a method of macerating, and afterwards of boiling the dead body in oil of walnut.

I am, for my own part, of opinion, that there were several ways of preserving dead bodies from putrefaction: and that this would be no difficult matter, since different nations have all succeeded in the attempt. We have an example of this kind among the Guanches, the ancient inhabitants of the island of Teneriffe. Those who survived the general destruction of this people by the Spaniards, when they conquered this island, informed them, that the art of embalming was still preserved there; and that there was a tribe of priests among them possessed of the secret, which they kept concealed as a sacred mystery. As the greatest part of the nation was destroyed, the Spaniards could not arrive at a complete knowledge of this art; they only found out a few of the particulars. Having taken out the bowels, they washed the body several times in a ley made of the dried bark of the pine-tree, warmed, during the summer, by the sun, or by a stove in the winter. They afterwards anointed it with butter, or the fat of bears, which they had previously boiled with odoriferous herbs, such as sage and lavender. After this unction they suffered the body to dry; and then repeated the operation as often as it was necessary, until the whole substance was impregnated with the preparation. When it was become very light, it was then a certain sign that it was fit and properly prepared. They then rolled it up in the dried skins of goats; which, when they had a mind to save expense, they suffered to remain with the hair still growing upon them. Purchas assures us, that he has seen mummies of this kind in London; and mentions the name of a gentleman who had seen several of them in the island of Teneriffe, which were supposed to have been two thousand years old; but without any certain proofs of such great antiquity. This people, who probably came first from the coasts of Africa, might have learned this art from the Egyptians, as there was a traffic carried on from thence into the most internal parts of Africa.

Father Acosta and Garcilasso de la Vega make no doubt but that the Peruvians understood the art of preserving their dead for a very long space of time. They assert their having seen the bodies of several incas, that were perfectly preserved. They still preserved their hair and their eye-brows; but they had eyes made of gold, put in the places of those taken out. They were clothed in their usual habits, and seated in the manner of the Indians, their arms placed on their breasts. Garcilasso touched one of their fingers, and found it apparently as hard as wood; and the whole body was not heavy enough to overburden a weak man, who should attempt to carry it away. Acosta presumes that these bodies were embalmed with a bitumen of which the Indians knew the properties. Garcilasso, however, is of a different opinion, as he saw nothing bituminous about them; but he confesses that he did not examine them very particularly; and he regrets his not having inquired into the methods used for that purpose. He adds, that being a Peruvian his countrymen would not have scrupled to inform him of the secret, if they really had it still among them.

Garcilasso, thus being ignorant of the secret, makes use of some inductions to throw light upon the subject; he asserts, that the air is so dry and so cold at Cusco, that flesh dries there like wood, without corrupting; and he is of opinion, that they dried the body in snow before they applied the bitumen: he adds, that in the times of the incas, they usually dried the flesh which was designed for the use of the army; and that, when it had lost its humidity, it might be kept without salt, or any other preparation.

It is said, that at Spitzbergen, which lies within the arctic circle, and consequently in the coldest climate, bodies never corrupt nor suffer any apparent alteration, even though buried for thirty years. Nothing corrupts or putrefies in that climate; the wood which has been employed in building those houses where the train-oil is separated, appears as fresh as on the day it was first cut.

If excessive cold, therefore, be thus capable of preserving bodies from corruption, it is not less certain that a great degree of dryness produced by heat, produces the same effect. It is well known, that the men and animals that are buried in the sands of Arabia quickly dry up and continue in preservation for several ages, as if they had been actually embalmed. It has often happened, that whole caravans have perished in crossing those deserts, either by the burning winds that infest them, or by the sands which are raised by the tempest, and overwhelm every creature in certain ruin. The bodies of those persons are preserved entire; and they are often found in this condition by some accidental passenger. Many authors, both ancient and modern, make mention of such mummies as these; and Shaw says, that he has been assured that numbers of men, as well as other animals, have been thus preserved, for times immemorial, in the burning sands of Saibah, which is a place, he supposes, situated between Rasem and Egypt.

The corruption of dead bodies being entirely caused by the fermentation of the humours, whatever is capable of hindering or retarding this fermentation will contribute to their preservation. Both heat and cold, though so contrary in themselves, produce similar effects in this particular, by drying up the humours: the cold in condensing and thickening them, and the heat in evaporating them before they have time to act upon the solids. But. it is necessary that these extremes should be constant; for if they succeed each other so that cold shall follow heat, or dryness humidity, it must then necessarily happen that corruption must ensue.—However, in temperate climates there are natural causes capable of preserving dead bodies; among which we may reckon the quality of the earth in which they are buried. If the earth be drying and astringent, it will imbibe the humidity of the body; and it may probably be for this reason that the bodies buried in the monastery of the Cordeliers, at Thoulouse, do not putrefy, but dry in such a manner that they may be lifted up by one arm.

The gums, resins, and bitumens, with which dead bodies are embalmed, keep off the impressions which they would else receive from the alteration of the temperature of the air; and still more, if a body thus prepared be placed in a dry or burning sand, the most powerful means will be united for its preservation. We are not to be surprised, therefore, at what we are told by Chardin of the country of Chorasan, in Persia. The bodies which have been previously embalmed and buried in the sands of that country, as he assures us, are found to petrify, or, in other words, to become extremely hard, and are preserved for several ages. It is asserted that some of them have continued for a thousand years.

The Egyptians, as has been mentioned above, swathed the body with linen bands, and inclosed it in a coffin: however it is probable that with all these precautions, they would not have continued till now, if the tombs, or pits, in which they were placed, had not been dug in a dry chalky soil, which was not susceptible of humidity; and which was besides covered over with a dry sand of several feet thickness.

The sepulchres of the ancient Egyptians subsist to this day. Most travellers who have been in Egypt have described those of ancient mummies, and have seen the mummies interred there. These catacombs are within two leagues of the ruins of the city, nine leagues from Grand Cairo, and about two miles from the village of Zaccara. They extend from thence to the Pyramids of Pharaoh, which are about eight miles distant. These sepulchres lie in a field, covered with a fine running sand, of a yellowish colour. The country is dry and hilly; the entrance of the tombs is choked up with sand; there are many open; but several more that are still concealed. The inhabitants of the neighbouring village have no other commerce or method of subsisting, but by seeking out mummies, and selling them to such strangers as happen to be at Grand Cairo. This commerce, some years ago, was not only a very common, but a very gainful one. A complete mummy was often sold for twenty pounds: but it must not be supposed that it was bought at such a high price from a mere passion for antiquity; there were much more powerful motives for this traffic. Mummy, at that time, made a considerable article in medicine; and a thousand imaginary virtues were ascribed to it, for the cure of most disorders, particularly of the paralytic kind. There was no shop, therefore, without mummy in it; and no physician thought he had properly treated his patient, without adding this to his prescription. Induced by the general repute in which this supposed drug was at that time, several Jews, both of Italy and France, found out the art of imitating mummy so exactly, that they for a long time deceived all Europe. This they did by drying dead bodies in ovens, after having prepared them with myrrh, aloes, and bitumen. Still, however, the request for mummies continued, and a variety of cures were daily ascribed to them. At length, Paræus wrote a treatise on their total inefficacy in physic; and showed their abuse in loading the stomach, to the exclusion of more efficacious medicines. From that time, therefore, their reputation began to decline; the Jews discontinued their counterfeits, and the trade returned entire to the Egyptians, when it was no longer of value. The industry of seeking after mummies is now totally relaxed, their price merely arbitrary, and just what the curious are willing to give.

In seeking for mummies, they first clear away the sand, which they may do for weeks together, without finding what is wanted. Upon coming to a little square opening, of about eighteen feet in depth, they descend into it by holes for the feet, placed at proper intervals, and there they are sure of finding what they seek for. These caves, or wells, as they call them, are hollowed out of a white freestone, which is found in all this country, a few feet below the covering of sand. When one gets to the bottom of these, which are sometimes forty feet below the surface, there are several square openings on each side, into passages of ten or fifteen feet wide, and these lead to chambers of fifteen or twenty feet square. These are all hewn out of the rock; and in each of the catacombs are to be found several of these apartments, communicating with each other. They extend a great way under ground, so as to be under the city of Memphis, and in a manner to undermine its environs.

In some of the chambers, the walls are adorned with figures and hieroglyphics; in others, the mummies are found in tombs round the apartment hollowed out in the rock. These tombs are upright, and cut into the shape of a man, with his arms stretched out. There are others found, and these in the greatest number, in wooden coffins, or in cloths covered with bitumen.[1] These coffins, or wrappers, are covered all over with a variety of ornaments. There are some of them painted, and adorned with figures, such as that of Death, and the leaden seals, on which several characters are engraven. Some of these coffins are carved into the human shape; but the head alone is distinguishable; the rest of the body is all of a piece, and terminated by a pedestal, while there are some with their arms hanging down; and it is by these marks that the bodies of persons of rank are distinguished from those of the meaner order. These are generally found lying on the floor, without any profusion of ornaments; and in some chambers the mummies are found indiscriminately piled upon each other, and buried in the sand.

Many mummies are found lying on their backs; their heads turned to the north, and their hands placed on the belly. The bands of linen, with which these were swathed, are found to be more than a thousand yards long; and, of consequence, the number of circumvolutions they make about the body must have been amazing. These were performed by beginning at the head, and ending at the feet; but they contrived it so as to avoid covering the face. However, when the face is entirely uncovered, it moulders into dust immediately upon the admission of the air. When, therefore, it is preserved entire, a slight covering of cloth is so disposed over it, that the shape of the eyes, the nose, and the mouth, are seen under it. Some mummies have been found with a long beard, and hair that reached down to the mid-leg, nails of a surprising length, and some gilt, or at least painted of a gold colour. Some are found with bands upon the breast, covered with hieroglyphics, in gold, silver, or in green; and some with tutelary idols, and other figures of jasper, within their body. A piece of gold also has often been found under their tongues, of about two pistoles value; and, for this reason, the Arabians spoil all the mummies they meet with, in order to get at the gold.[1]

---

[1] In the case of distinguished or very wealthy persons, sarcophagi or stone-coffins, instead of wooden ones, were used. These coffins consist of two parts,—a large case, cut out of one piece of stone, large enough to contain the mummy with all its cases, and open at the top, and the other a lid to fit the opening. There are several specimens of these sarcophagi in the British Museum, but only one of the larger sort has a lid, which is rounded into the general outline of the human form, with a face in high relief, and a general appearance analogous to that of the wooden coffins: this coffin is of granite. There are two very large ones which have no lids: one is of a species of basalt, or perhaps breccia, and the other is a breccia similar to what the Italians call *breccia verde*. The coffin which is of this last material is a very curious and elaborate work, which has given occasion to much speculation. This sarcophagus is rounded at one end and flat at the other, the rest of it having the appearance of a large box. It is about three feet ten inches in length; four feet two inches wide at the feet, and five feet four inches at the head,—the height being about three feet nine inches. Both the exterior and interior surfaces of this vast coffin are sculptured with a multitude of characters, and human and animal figures, which are more numerous, however, on the outside. This is a most astonishing work, when we consider the hardness of the material, the generally correct outline of the animal forms, and the minuteness of the work,—from eight to twelve hieroglyphics being in some parts included in the space of a square inch. The sculptured superficies exceeds 100 square feet (French), and the number of figures is said to be more than 21,700. The other sarcophagi have also their surfaces sculptured in the same style, but not so minutely and elaborately. Another large and similar sarcophagus (of alabaster), covered with sculptures, which afford curious illustrations of the arts, customs, and religion of the Egyptians, was brought to this country by Belzoni, and is now in the museum of Sir John Soane, who purchased it for £2000. These elaborate sculptures probably record the titles, actions, and merits of the kings or heroes whose mortal remains these wonderful coffins were destined to receive. Of Sir John Soane's sarcophagus there is an account, with valuable engraved illustrations, in Britton's 'Union of Architecture, Sculpture, and Painting,' 1827.

Besides these larger sarcophagi, there are two beautiful and perfect specimens in the Museum, of smaller stone coffins, one of black and the other of white marble, very highly polished. They are of a rounded form, in the outline of the human shape, and of really elegant proportions. The concave lids are sculptured, having at the top well-executed faces, one of a man and the other of a woman. These are so small that is is impossible they could have contained a wooden mummy-case. It would therefore seem that sometimes, after the mummy had been swathed, and perhaps enclosed in a pasteboard case, it was placed at once in a stone receptacle, without the intervention of the usual wooden case;—it seems indeed to have been an exchange for such a case.

But although art, or accident, has thus been found to preserve dead bodies entire, it must by no means be supposed that it is capable of preserving the exact form and lineaments of the deceased person. Those bodies which are found dried away in the deserts, or in some particular church-yards, are totally deformed, and scarcely any lineaments remain of their external structure. Nor are the mummies preserved by embalming, in a better condition. The flesh is dried away, hardened and hidden under a variety of bandages; the bowels, as we have seen, are totally removed; and from hence, in the most perfect of them, we see only a shapeless mass of skin discoloured; and even the features scarcely distinguishable. The art is, therefore, an effort rather of preserving the substance than the likeness of the deceased; and has, consequently, not been brought to its highest pitch of perfection. It appears from a mummy not long since dug up in France, that the art of embalming was more completely understood in the western world than even in Egypt. This mummy, which was dug up at Auvergne, was an amazing instance of their skill, and is one of the most curious relics in the art of preservation. As some peasants, in that part of the world, were digging in a field, near Rion, within about twenty-six paces off the highway, between that and the river Artiers, they discovered a tomb, about a foot and a half beneath the surface. It was composed only of two stones; one of which formed the body of the sepulchre, and the other the cover. This tomb was of free-stone, seven feet and a half long, three feet and a half broad, and about three feet high. It was of rude workmanship; the cover had been polished, but was without figure or inscription: within this tomb was placed a leaden coffin, four feet seven inches long, fourteen inches broad, and fifteen high. It was not made coffin-fashion, but oblong, like a box, equally broad at both ends, and covered with a lid that fitted on like a snuff-box, without a hinge. This cover had two holes in it, each of about two inches long, and very narrow, filled with a substance resembling butter; but for what purpose intended remains unknown. Within this coffin was a mummy, in the highest and most perfect preservation. The internal sides of the coffin were filled with an aromatic substance, mingled with clay. Round the mummy was wrapped a coarse cloth, in form of a napkin; under this were two shirts, or shrouds, of the most exquisite texture; beneath these a bandage, which covered all parts of the body, like an infant in swaddling-clothes; still under this general bandage there was another, which went particularly round the extremities, the hands, and the legs. The head was covered with two caps; the feet and hands were without any particular bandages; and the whole body was covered with an aromatic substance an inch thick. When these were removed, and the body exposed naked to view, nothing could be more astonishing than the preservation of the whole, and the exact resemblance it bore to a body that had been dead a day or two before. It appeared well proportioned, except that the head was rather large, and the feet small. The skin had all the pliancy and colour of a body lately dead: the visage, however, was of a brownish hue. The belly yielded to the touch; all the joints were flexible, except those of the legs and feet; the fingers stretched forth of themselves when bent inwards. The nails still continued entire; and all the marks of the joints, both in the fingers, the palms of the hands, and the soles of the feet, remained perfectly visible. The bones of the arms and legs were soft and pliant; but, on the contrary, those of the skull preserved their rigidity; the hair, which only covered the back of the head, was of a chestnut colour, and about two inches long. The pericranium at top was separated from the skull by an incision, in order to open it for the introducing proper aromatics in the place of the brain, where they were found mixed with clay. The teeth, the tongue, and the ears, were all preserved in perfect form. The intestines were not taken out of the body, but remained pliant and entire, as in a fresh subject; and the breast was made to rise and fall like a pair of bellows. The embalming preparation had a very strong and pungent smell, which the body preserved for more than a month after it was exposed to the air. This odour was perceived wherever the mummy was laid; although it remained there but a very short time, it was even pretended that the peasants of the neighbouring villages were incommoded by it. If one touched either the mummy, or part of the preparation, the hands smelled of it for several hours after, although washed with water, spirit of wine, or vinegar. This mummy, having remained exposed for some months to the curiosity of the public, began to suffer some mutilations. A part of the skin of the forehead was cut off, the teeth were drawn out, and some attempts were made to pull away the tongue. It was, therefore, put into a glass-case, and shortly after transmitted to the king of France's cabinet at Paris.

---

[1] The following account of the general appearance of an Egyptian mummy is extracted from a journal of M. Villoteau:—"The 5th October, 1800, having left Carnak we passed to the other bank of the Nile, and encamped opposite the village of Gourney. Scarcely were we encamped, when we saw some men approach with dead bodies on their shoulders, which turned out to be mummies. They put them on the ground, and offered them for sale. One was the mummy of a female, very well preserved. As we wished to know how it had been embalmed and swathed, we took off the outer covering, consisting of an upper and a lower part, the opening of which had been laced in front. With much care we took off a great number of bandages, which passed round the legs and feet, the thighs, the body, arms and head; and after this we began to distinguish more clearly the forms of the extremities, the head, feet, and hands, while the shape of the bosom and body were still but faintly seen.

"As we came nearer the skin, the bandages were broader, and the extremities became more distinct. At last, we could clearly distinguish the nails of the fingers and toes, the nose, mouth, and eyes. Finally, we came to a kind of envelope, which covered every part; so that we took off in a single piece the part which covered the higher division of the face, and which preserved perfectly the form of the projecting features. The other parts were more covered in proportion, but those where the embalmer had been skilful enough to fill up the form, showed us nothing but black and dry members. The shape and the colour of the nails, which were expressed on the envelope, disappeared.

"Yet all the parts of the body, though dried, retained their natural form. The hair, eyes, nose, and mouth were so well preserved, that one could easily recognise the expression of countenance which they must have produced. The hair was quite black, without any mixture of white hair, though the person appeared to have been old at the time of death. All that we could observe was, that it was a little red near the roots. The hair was well fixed, long, and divided into plaits, fastened up on the head rather carelessly; which makes me infer, that at that time the women let their hair fall down along their back in numerous tresses.

"The eye-lids, lashes, and eye-brows were still in their natural state. The eyes only appeared to be slightly injured, because they were dried, and the pupil had shrunk in a little. The nose was pretty nearly in its natural state, very regularly formed, and very beautiful. The tongue was dry, and like a piece of parchment. The lips were thin, and the mouth small. The teeth appeared to be worn out through old age, and to have lost their sharpness, but they were all there, and seemed not to have been decayed. Even at the present day it is remarkable that the natives of Egypt have very good teeth, which they keep to the most advanced age. The head of this mummy presented in general a tolerably regular oval. The body had been opened on the left side of the stomach, in order to get at the entrails, and to introduce the aromatic substances; and we drew out enough to satisfy ourselves that these were resinous materials.

"This female mummy had the arms and hands extended and placed along the body, while a male mummy which we examined had the arms crossed on the breast; facts which we observed to be of regular occurrence in the female and male mummies."

There are many reasons to believe this to be the body of a person of the highest distinction; however, no marks remain to assure us either of the quality of the person, or the time of his decease. There are only to be seen some irregular figures on the coffin; one of which represents a kind of star. There were also some singular characters upon the bandages, which were totally defaced by those who had torn them away. However, it should seem that it had remained for several ages in this state, since the first years immediately succeeding the interment, are usually those in which the body is most liable to decay. It appears also to be a much more perfect method of embalming than that of the Egyptians; as in this the flesh continues with its natural elasticity and colour, the bowels remain entire, and the joints have almost the pliancy which they had when the person was alive. Upon the whole, it is probable that a much less tedious preparation than that used by the Egyptians would have sufficed to keep the body from putrefaction; and that an injection of petroleum inwardly, and that a layer of asphaltum without, would have sufficed to have made a mummy; and it is remarkable that Auvergne, where this was found, affords these two substances in sufficient plenty. This art, therefore, might be brought to greater perfection than it has arrived at hitherto, were the art worth preserving. But mankind have long since grown wiser in this respect; and think it unnecessary to keep by them a deformed carcase, which, instead of aiding their magnificence, must only serve to mortify their pride.

CHAP. XIV.

OF ANIMALS.

Leaving man, we now descend to the lower ranks of animated nature, and prepare to examine the life, manners, and characters of these our humble partners in the creation. But, in such a wonderful variety as is diffused around us, where shall we begin? The number of beings endued with life, as well as we, seems, at first view, infinite. Not only the forest, the waters, the air, teems with animals of various kinds; but almost every vegetable, every leaf, has millions of minute inhabitants, each of which fill up the circle of its allotted life, and some are found objects of the greatest curiosity. In this seeming exuberance of animals, it is natural for ignorance to lie down in hopeless uncertainty, and to declare what requires labour to particularize to be utterly inscrutable. It is otherwise, however, with the active and searching mind; no way intimidated with the immense variety, it begins the task of numbering, grouping, and classing, all the various kinds that fall within its notice; finds every day new relations between the several parts of the creation; acquires the art of considering several at a time under one point of view; and, at last, begins to find that the variety is neither so great nor so inscrutable as was at first imagined. As in a clear night, the number of stars seems infinite; yet, if we sedulously attend to each in its place, and regularly class them, they will soon be found to diminish, and come within a very scanty computation.

Method is one of the principal helps in natural history, and without it very little progress can be made in this science. It is by that alone we can hope to dissipate the glare, if I may so express it, which arises from a multiplicity of objects at once presenting themselves to the view. It is method that fixes the attention to one point, and leads it, by slow and certain degrees, to leave no part of nature unobserved.

All naturalists, therefore, have been very careful in adopting some method of classing or grouping the several parts of nature; and some have written books of natural history with no other view. These methodical divisions some have treated with contempt,[1] not considering that books, in general, are written with opposite views; some to be read, and some only to be occasionally consulted. The methodists in natural history seem to be content with the latter advantage; and have sacrificed to order alone, all the delights of the subject, all the arts of heightening, awakening, or continuing curiosity. But they certainly have the same use in science, that a dictionary has in language; but with this difference, that in a dictionary we proceed from the name to the definition; in a system of natural history, we proceed from the definition to find out the thing. Without the aid of system, nature must still have lain undistinguished, like furniture in a lumber-room: every thing we wish for is there indeed, but we know not where to find it. If, for instance, in a morning excursion, I find a plant, or an insect, the name of which I desire to learn; or, perhaps, am curious to know whether already known; in this inquiry I can expect information only from one of these systems, which being couched in a methodical form, quickly directs me to what I seek for. Thus we will suppose that our inquirer has met with a spider, and that he has never seen such an insect before. He is taught by the writer of a system[2] to examine whether it has wings, and he finds it has none. He, therefore, is to look for it among the wingless insects, or the Aptera, as Linnæus calls them: he then is to see whether the head and breast make one part of the body, or are disunited; he finds they make one: he is then to reckon the number of feet and eyes, and he finds that it has eight of each. The insect, therefore, must be either a scorpion or a spider; but he lastly examines its feelers, which he finds clavated, or clubbed: and, by all these marks, he at last discovers it to be a spider. Of spiders there are forty-seven sorts; and, by reading the description of each, the inquirer will learn the name of that which he desires to know. With the name of the insect, he is also directed to those authors that have given any account of it, and the page where that account is to be found; by this means he may know at once what has been said of that animal by others, and what there is of novelty in the result of his own researches.

From hence it will appear how useful those systems in natural history are to the inquirer; but, having given them all their merit, it would be wrong not to observe, that they have, in general, been very much abused. Their authors, in general, seem to think that they are improvers of natural history, when in reality they are but guides; they seem to boast that they are adding to our knowledge, while they are only arranging it. These authors, also, seem to think that the reading of their works and systems is the best method to attain a knowledge of nature; but setting aside the impossibility of getting through whole volumes of a dry long catalogue, the multiplicity of whose contents is too great for even the strongest memory, such works rather tell us the names than the history of the creature we desire to inquire after. In these dreary pages, every insect or plant, that has a name, makes as distinguished a figure as the most wonderful, or the most useful. The true end of studying nature, is to make a just selection, to find those parts of it that most conduce to our pleasure or convenience, and to leave the rest in neglect. But these systems, employing the same degree of attention upon all, give us no opportunities of knowing which most deserves attention; and he who has made his knowledge from such systems only, has his memory crowded with a number of trifling or minute particulars, which it should be his business and his labour to forget. These books, as was said before, are useful to be consulted, but they are very unnecessary to be read; no inquirer into nature should be without one of them; and, without any doubt, Linnæus deserves the preference.

---

[1] Mr Buffon in his Introduction, &c.

[2] Linnæus.

One fault more, in almost all these systematic writers, and that which leads me to the subject of the present chapter, is, that seeing the necessity of methodical distribution in some parts of nature, they have introduced it into all. Finding the utility of arranging plants, birds, or insects, they have arranged quadrupeds also with the same assiduity; and although the number of these is so few as not to exceed two hundred,[1] they have darkened the subject with distinctions and divisions, which only serve to puzzle and perplex. All method is only useful in giving perspicuity, where the subject is either dark or copious; but with regard to quadrupeds, the number is but few; many of them we are well acquainted with by habit; and the rest may very readily be known, without any method. In treating of such, therefore, it would be useless to confound the reader with a multiplicity of divisions; as quadrupeds are conspicuous enough to obtain the second rank in nature, it becomes us to be acquainted with, at least, the names of them all. However, as there are naturalists who have gained a name from the excellence of their methods in classing these animals, some readers may desire to have a knowledge of what has been laboriously invented for their instruction. I will just take leave, therefore, to mention the most applauded methods of classing animals, as adopted by Ray, Klein, and Linnæus; for it often happens, that the terms which have been long used in a science, though frivolous, become, by prescription, a part of the science itself.[2]

Ray, after Aristotle, divides all animals into two kinds; those which have blood, and those which are bloodless. In the last class, he places all the insect tribes. The former he divides into such as breathe through the lungs, and such as breathe through gills: these last comprehend the fishes. In those which breathe through the lungs, some have the heart composed of two ventricles, and some have it of one. Of the last are all animals of the cetaceous kind, all oviparous quadrupeds, and serpents. Of those that have two ventricles, some are oviparous, which are the birds; and some viviparous, which are quadrupeds. The quadrupeds, he divides into such as have a hoof, and such as are claw-footed. Those with the hoof, he divides into such as have it undivided, such as have it cloven, and such as have the hoof divided into more parts, as the rhinoceros, and hippopotamus. Animals with the cloven hoof, he divides into such as chew the cud, as the cow and the sheep; and such as are not ruminant, as the hog. He divides those animals that chew the cud, into four kinds; the first have hollow horns, which they never shed, as the cow; the second is of a less species, and is of the sheep kind; the third is of the goat kind; and the last, which have solid horns, and shed them annually, are of the deer kind. Coming to the claw-footed animals, he finds some with large claws, resembling the fingers of the human hand: and these he makes the ape kind. Of the others, some have the foot divided in two, having a claw to each division; these are the camel kind. The elephant makes a kind by itself, as its claws are covered over by a skin. The rest of the numerous tribe of claw-footed animals he divides into two kinds; the analogous, or such as resemble each other; and the anomalous, which differ from the rest. The analogous claw-footed animals, are of two kinds; they have more than two cutting teeth in each jaw, such as the lion and the dog, which are carnivorous; or they have but two cutting teeth in each jaw, and these are chiefly fed upon vegetables. The carnivorous kinds are divided into the great and the little. The great carnivorous animals are divided into such as have a short snout, as the cat and the lion: and such as have it long and pointed, as the dog and the wolf. The little claw-footed carnivorous animals, differ from the great, in having a proportionably smaller head, and a slender body, that fits them for creeping into holes, in pursuit of their prey like worms; and they are therefore called the vermin kind.

---

[1] In Dr Shaw's General Zoology, the number of quadrupeds, not including the cetaceous and seal tribes, amount to five hundred and twelve, besides their varieties.

[2] Goldsmith throughout speaks too slightingly of the systems adopted by naturalists in illustration of their science. The immense number of facts embraced by natural history could never be retained in the memory without an arrangement of divisions and subdivisions founded upon some distinguishing characteristics. Aristotle's system of arrangement was simple, resting on divisions derived mainly from the external structure, food, habits and locality. But though neither human nor comparative anatomy was then sufficiently cultivated to enable him to make the internal structure of animals the basis of his divisions, yet Aristotle was not insensible to the advantages of a more scientific distribution, and, with his usual sagacity, recommends to succeeding writers to turn their attention in that direction. Ray followed the advice of the great master, and remarked the great distinction, that some animals possessed lungs and a sanguineous system, while others were destitute of both. Linnæus, proceeding on the general arrangement of Ray, but with many extensions and improvements, divided the animal kingdom into six classes, founded mainly on the differences in the respiratory and sanguineous systems.

Class I.—*Mammalia.* All suckle their young; the heart has two auricles and two ventricles; blood red and warm; viviparous.

Class II. *Aves* (Birds). Characters of sanguineous system as in first class; viviparous.

Class III. *Amphibia.* Heart one auricle and one ventricle; blood red and cold; respiration voluntary.

Class IV. *Pisces* (Fishes). Heart and blood as in *amphibia*; respiration by gills.

Class V. *Insecta.* Heart one ventricle and no auricle; sanies cold, colourless; antennæ, or feelers.

Class VI. *Vermes* (Worms). Characters as in V, except no antennæ, but tentacula.

He then subdivides the *Mammalia* into seven orders, the distinctness of which are taken from the difference in the number, form and situation of the teeth, without, however, neglecting the feet.

Order 1. *Primates.* Four incisors in each jaw, and one canine.—Genera: *homo, simia, lemur, vespertilio.*—2. *Bruta.* No incisors.—Genera: *rhinoceros, elephas, trichechus, bradypus, myrmecophaga, manis, dasypus.*—3. *Feræ.* Six conical incisors in each jaw; for the most part.—Genera: *phoca, canis, felis, viverra, mustela, ursus, didelphis, talpa, sorex, erinaceus.*—4. *Glires.* Two incisors in each jaw; no canines.—Genera: *hystrix, lepus, castor, mus, sciurus, myoxus, cavia, arctomys, dipus, hyrax.*—5. *Pecora.* No foreteeth in the upper jaw; six or eight in the under.—Genera: *camelus, moschus, giraffa, cervus, antilope, capra, ovis, bos.*—6. *Belluæ.* Obtuse fore-teeth in each jaw.—Genera: *equus, hippopotamus, sus, tapir.*—7. *Cete.* No uniform character of teeth; aquatic pectoral fins; spiracula.—Genera: *monodon, balæna, physeter, delphinus.*

The other classes are subdivided in a similar manner. We shall enumerate only the orders. The distinctions of the *Aves* are taken chiefly from the beak; but the tongue, nostrils, feet, and other parts, are sometimes called in.

Order 1. *Accipitres.*—2. *Picæ.*—3. *Anseres.*—4. *Grallæ.*—5. *Gallinæ.*—6. *Passeres.*

The *Amphibia* are divided into two orders.

Order 1. *Reptilia.* Furnished with feet, and breathing through the mouth.—2. *Serpentes.* Destitute of feet, and breathing through the mouth.

The fourth class, *Pisces*, is subdivided into six orders, the characters of which are taken from the belly-fins.

Order 1. *Apodes.* No ventral fins; embraces the eel kind, torpedo, &c.—2. *Jugulares.* Ventral fins placed before the pectoral; cod, blenny, &c.—3. *Thoracici.* Ventral fins under the pectoral; sucking-fish, goby, plaice, doree, &c.—4. *Abdominales.* Ventral fins placed behind the pectoral; skate, salmon, pike, &c.—5. *Branchiostegi.* Gills destitute of long rays; sun-fish, pipe-fish, &c.—6. *Chondropterygii.* Cartilaginous gills; lamprey, ray, shark, &c.

The fifth class, that of *Insects*, is divided into seven orders, the characters of which are mostly taken from the differences observed in the number and texture of the wings.

Order 1. *Coleoptera.*—2. *Hemiptera.*—3. *Lepidoptera.*—4. *Neuroptera.*—5. *Hymenoptera.*—6. *Diptera.*—7. *Aptera.*

We see, from this sketch of division and subdivision, how a subject, extremely delightful and amusing in itself, may be darkened and rendered disgusting. But, notwithstanding, Ray seems to be one of the most simple distributors; and his method is still, and not without reason, adopted by many. Such as have been at the trouble to learn this method, will certainly find it useful: nor would we be thought, in the least, to take from its merits; all we contend for is, that the same information may be obtained by a pleasanter and an easier method.

It was the great success of Ray's method, that soon after produced such a variety of attempts in the same manner; but almost all less simple, and more obscure. Mr Klein's method is briefly as follows; he makes the power of changing place, the characteristic

---

The sixth class, *Vermes*, is subdivided into five orders. ORDER 1. *Intestina*.—2. *Mollusca*.—3. *Testacea*.—4. *Zoophyta*.—5. *Infusoria*.

The arrangement of Linnæus, with all its advantages, had its defects. By confining himself too much to one kind of character, he often throws together subjects widely remote in their general appearance and economy; but he has carried the art of distribution, and the management of characters, to such a degree of clearness and brevity, that any person familiarized to his language may easily find the name and place of any being he wishes to observe. It still remained a desideratum to arrange the facts, of which the science treats, in a series of propositions, so graduated and successively subordinate, that the whole might represent the actual relations of living beings. For this purpose, it was necessary to group animals according to their different properties or organizations, so that those contained in such a group should bear a stronger natural resemblance to each other than to any individual of a different group. This arrangement is termed the *natural* method, for the formation of which zoology offers great facilities. In the arrangement of Cuvier, the completest and most scientific yet presented to the world, the great division of the animal world rests on the nervous and sensorial, and not on the circulatory and respiratory, systems. From the study of the physiology of the natural classes of vertebrated animals, Cuvier discovered the respective quantity of respiration, the reason of the quantity or degree of motion, and, consequently, the peculiar nature of that motion. This last gives rise to the peculiar form of their skeletons and muscles; and with it the energy of their sensations, and the force of their digestion, are in a necessary relation. Thus zoological arrangement, which had hitherto rested on observation alone, assumed a truly scientific form. Calling in the aid of comparative anatomy, it involves propositions applicable to new cases, and thus becomes a means of discovery as well as a register of facts; and, by correct reasoning, founded on copious induction, it partakes of the demonstration of mathematics, and the certainty of experimental knowledge. Having examined the modifications which take place in the organs of circulation, respiration and sensation in the invertebrated animals (a title first given by Lamarck, instead of the erroneous one of *white-blooded* animals, by which they were previously distinguished,) Cuvier has formed a new division, in which these animals are arranged according to their actual relations. Cuvier's system is comprehended in four grand divisions, namely,—I. VERTEBRATED ANIMALS, or those animals which have a backbone, or spine. II. MOLLUSCOUS ANIMALS, or animals which are destitute of a spine, or bones of any kind, as snails, &c. III. ARTICULATED ANIMALS, which have no internal bones, but whose members are articulated by an external crust or shell, as crabs, &c.; and, IV. RADIATED ANIMALS, or such as those whose members radiate from a common centre, as exemplified in star-fish, &c. An analysis of the Cuverian and other modern systems will form the Appendix to the present work.

mark of animals in general; and he takes their distinctions from their aptitude and fitness for such a change. Some change place by means of feet, or some similar contrivance; others have wings and feet: some can change place only in water, and have only fins: some go upon earth, without any feet at all: some change place, by moving their shell; and some move only at a certain time of the year. Of such, however, as do not move at all, he takes no notice. The quadrupeds that move chiefly by means of four feet upon land he divides into two orders. The first are the hoofed kind; and the second, the claw. Each of these orders is divided into four families. The first family of the hoofed kind, are the single hoofed, such as the horse, ass, &c. The second family are such as have the hoof cloven into two parts, such as the cow, &c. The third family have the hoof divided into three parts, and in this family is found only the rhinoceros. The fourth family have the hoof divided into five parts; and in this is only to be found the elephant. With respect to the clawed kind, the first family comprehends those that have but two claws on each foot, as the camel; the second family have three claws; the third, four; and the fourth, five. This method of taking the distinctions of animals from the organs of motion, is ingenious; but is, at the same time, incomplete; and, besides, the divisions into which it must necessarily fall are inadequate; since, for instance, in his family with two claws, there is but one animal; whereas, in his family with five claws, there are above a hundred.

Brisson, who has laboured this subject with great accuracy, divides animated nature into nine classes; namely, quadrupeds; cetaceous animals, or those of the whale kind; birds; reptiles, or those of the serpent kind: cartilaginous fishes; spinous fishes; shelled animals; insects; and worms. He divides the quadrupeds into eighteen orders; and takes their distinctions from the number and form of their teeth.

But of all those whose systems have been adopted and admired, Linnæus is the foremost; as with a studied brevity his system comprehends the greatest variety in the smallest space.

According to him, the first distinction of animals is to be taken from their internal structure. Some have the heart with two ventricles, and hot red blood; namely, quadrupeds and birds. The quadrupeds are viviparous, and the birds oviparous.

Some have the heart with but two ventricles, and cold red blood; namely, amphibia and fishes. The amphibia are furnished with lungs; the fishes with gills.

Some have the heart with one ventricle, and cold white serum; namely, insects and worms; the insects have feelers; and the worms, holders.

The distinctions of quadrupeds or animals with paps, as he calls them, are taken from their teeth. He divides them into seven orders; to which he gives names that are not easy of translation: Primates, or principals, with four cutting teeth in each jaw; Bruta, or brutes, with no cutting teeth; Feræ, or wild beasts, with generally six cutting teeth in each jaw; Glires, or dormice, with two cutting teeth, both above and below; Pecora, or cattle, with many cutting teeth above, and none below; Belluæ, or beasts, with the fore-teeth blunt; Cete, or those of the whale kind, with cartilaginous teeth. I have but just sketched out this system, as being, in its own nature, the closest abridgment: it would take volumes to dilate it to its proper length. The names of the different animals, and their classes, alone make two thick octavo volumes; and yet nothing is given but the slightest description of each. I have omitted all criticism also upon the accuracy of the preceding systems; this has been done both by Buffon and Daubenton, not with less truth than humour; for they had too much good sense not to see the absurdity of multiplying the terms of science to no end, and disappointing our curiosity rather with a catalogue of nature's varieties, than a history of nature.

Instead, therefore, of taxing the memory and teasing the patience with such a variety of divisions and subdivisions, I will take leave to class the productions of nature in the most obvious, though not in the most accurate, manner. In natural history, of all other sciences, there is the least danger of obscurity. In morals, or in metaphysics, every definition must be precise, because those sciences are built upon definitions; but it is otherwise in those subjects where the exhibition of the object itself is always capable of correcting the error. Thus it may often happen, that in a lax system of natural history, a creature may be ranked among quadrupeds that belongs more properly to the fish or the insect classes. But that can produce very little confusion, and every reader can thus make a system the most agreeable to his own imagination. It will be of no manner of consequence whether we call a bird or insect a quadruped, if we are careful in marking all its distinctions: the uncertainty in reasoning, or thinking, that these approximations of the different kinds of animals produce, is but very small, and happens but very rarely; whereas the labour that naturalists have been at to keep the kinds asunder, has been excessive. This, in general, has given birth to that variety of systems which we have just mentioned, each of which seems to be almost as good as the preceding.

Taking, therefore, this latitude, and using method only where it contributes to conciseness or perspicuity, we shall divide animated nature into four classes; namely, Quadrupeds, Birds, Fishes, and Insects. All these seem in general pretty well distinguished from each other by nature; yet there are several instances in which we can scarcely tell whether it is a bird or a quadruped that we are about to examine; whether it is a fish or an insect that offers to our curiosity. Nature is varied by imperceptible gradations, so that no line can be drawn between any two classes of its productions, and no definition made to comprehend them all. However, the distinctions between these classes are sufficiently marked, and their encroachments upon each other are so rare, that it will be sufficient particularly to apprise the reader when they happen to be blended.

There are many qnadrupeds that we are well acquainted with: and of those we do not know, we shall form the most clear and distinct conceptions, by being told wherein they differ, and wherein they resemble those with which we are familiar. Each class of quadrupeds may be ranged under some one of the domestic kinds, that may serve for the model by which we are to form some kind of idea of the rest. Thus we may say that a tiger is of the cat kind, a wolf of the dog kind, because there are some rude resemblances between each; and a person who has never seen the wild animals, will have some incomplete knowledge of their figure from the tame ones. On the contrary, I will not, as some systematic writers have done,[1] say that the bat is of the human kind, or a hog of the horse kind, merely because there is some resemblance in their teeth, or their paps. For although this resemblance may be striking enough, yet a person who has never seen a bat or a hog, will never form any just conception of either by being told of this minute similitude. In short, the method in classing quadrupeds should be taken from their most striking resemblances; and where these do not offer, we shall not force the similitude, but leave the animal to be described as a solitary species. The number of quadrupeds is so few, that indeed, without any method whatever, there is no great danger of confusion.

All quadrupeds, the number of which, according to Buffon, amounts to but two hundred, may be classed in the following manner.

First, those of the horse kind. This class contains the Horse, the Ass, and the Zebra. Of these none have horns, and their hoof is of one solid piece.

The second class are those of the Cow kind; comprehending the Urus, the Buffalo, the Bison, and the Bonassus. These have cloven hoofs, and chew the cud.

The third class is that of the Sheep kind, with cloven hoofs, and chewing the cud like the former. In this is comprehended the Sheep, the Goat, the Lama, the Vigogne, the Gazella, the Guinea Deer, and all of a similar form.

The fourth class is that of the Deer kind, with cloven hoofs, and with solid horns, that are shed every year. This class contains the Elk, the Rein-deer, the Stag, the Buck, the Roe-buck, and the Axis.

The fifth class comprehends all those of the Hog kind, the Peccari, and the Babyrouessa.

The sixth class is that numerous one of the Cat kind. This comprehends the Cat, the Lion, the Panther, the Leopard, the Jaguar, the Cougar, the Jaguarette, the Lynx, the Ounce, and the Catamountain. These are all carnivorous, and furnished with crooked claws, which they can sheathe and unsheathe at pleasure.

The seventh class is that of the Dog kind, carnivorous, and furnished with claws like the former, but which they cannot sheathe. This class comprehends the Dog, the Wolf, the Fox, the Jackal, the Isatis, the Hyæna, the Civet, the Gibet, and the Genet.

The eighth class is that of the Weasel kind, with a long small body, with five toes, or claws, on each foot; the first of them separated from the rest like a thumb. This comprehends the Weasel, the Martin, the Pole-cat, the Ferret, the Mangoust, the Vansire, the Ermine, with all the varieties of the American Moufettes.

The ninth class is that of the Rabbit kind, with two large cutting teeth in each jaw. This comprehends the Rabbit, the Hare, the Guinea-pig, all the various species of the Squirrel, the Dormouse, the Marmotte, the Rat, the Mouse, the Agouti, the Paca, the Aperea, and the Tapeti.

The tenth class is that of the Hedge-hog kind, with claw-feet, and covered with prickles; comprehending the Hedge hog and the Porcupine, the Couando and the Urson.

The eleventh class is that of the Tortoise kind, covered with a shell, or scales. This comprehends the Tortoise, the Pangolin, and the Phataguin.

The twelfth is that of the Otter, or amphibious kind; comprehending the Otter, the Beaver, the Desman, the Morse, and the Seal.

The thirteenth class is that of the Ape and Monkey kinds, with hands, and feet resembling hands.

The fourteenth class is that of winged quadrupeds, or the Bat kind; containing the Bat, the Flying Squirrel, and some other varieties.

---

[1] Linnæi Syst.

The animals which seem to approach no other kind, either in nature or in form, but to make each a distinct species in itself, are the following; the Elephant, the Rhinoceros, the Hippopotamus, the Camelopard, the Camel, the Bear, the Badger, the Tapir, the Cabrai, the Coati, the Ant-bear, the Tatou, and lastly, the Sloth.

All other quadrupeds, whose names are not set down, will be found among some of the above-mentioned classes, and referred to that which they most resemble. When, therefore, we are at a loss to know the name of any particular animal, by examining which of the known kinds it most resembles, either in shape, or in hoofs, or claws, and then examining the particular description, we shall be able to discover not only its name, but its history. I have already said, that all methods of this kind are merely arbitrary, and that Nature makes no exact distinction between her productions. It is hard, for instance, to tell whether we ought to refer the civet to the dog or the cat kind; but, if we know the exact history of the civet, it is no great matter to which kind we shall judge it to bear the greatest resemblance. It is enough, that a distribution of this kind excites in us some rude outlines of the make, or some marked similitudes in the nature of these animals; but to know them with any precision, no system, or even description, will serve, since the animal itself, or a good print of it, must be seen, and its history be read at length, before it can be said to be known. To pretend to say that we have an idea of a quadruped, because we can tell the number or the make of its teeth, or its paps, is as absurd as we should pretend to distinguish men by the buttons of their clothes.[1] Indeed it often happens that the quadruped itself can be but seldom seen; that many of the more rare kinds do not come into Europe above once in an age, and some of them have never been able to bear the removal: in such a case, therefore, there is no other substitute but a good print of the animal, to give an idea of its figure; for no description whatsoever can answer this purpose so well. Mr Locke, with his usual good sense, has observed, that a drawing of the animal, taken from the life, is one of the best methods of advancing natural history; and yet most of our modern systematic writers are content rather with describing. Descriptions, no doubt, will go some way towards giving an idea of the figure of an animal; but they are certainly much the longest way about, and, as they are usually managed, much the most obscure. In a drawing we can, at a single glance, gather more instruction than by a day's painful investigation of methodical systems, where we are told the proportions with great exactness, and yet remain ignorant of the totality. In fact, this method of describing all things is a fault that has infected many of our books, that treat on the meaner arts, for this last age. They attempt to teach by words, what is only to be learnt by practice and inspection. Most of our dictionaries, and bodies of arts and sciences, are guilty of this error. Suppose, for instance, it be requisite to mention the manner of making shoes, it is plain that all the verbal instructions in the world will never give an adequate idea of this humble art, or teach a man to become a shoemaker. A day or two in a shoemaker's shop will answer the end better than a whole folio of instruction, which only serves to impress the learner with the weight of its pretended importance. We have lately seen a laborious work carried on at Paris, with this only intent, of teaching all the trades by description: however, the design at first blush seems to be ill considered; and it is probable that very few advantages will be derived from so laborious an undertaking. With regard to the descriptions in natural history, these, without all question, under the direction of good sense, are necessary; but still they should be kept within proper bounds; and, where a thing may be much more easily shown than described, the exhibition should ever precede the account.

CHAP. XV.

OF QUADRUPEDS IN GENERAL, COMPARED TO MAN.[1]

Upon comparing the various animals of the globe with each other, we shall find that quadrupeds demand the rank immediately next ourselves; and, consequently, come first in consideration. The similitude between the structure of their bodies and ours, those instincts which they enjoy in a superior degree to the rest, their constant services, or their unceasing hostilities, all render them the foremost objects of our curiosity, the most interesting parts of animated nature. These, however, although now so completely subdued, very probably, in the beginning, were nearer upon an equality with us, and disputed the possession of the earth. Man, while yet savage himself, was but ill qualified to civilize the forest. While yet naked, unarmed, and without shelter, every wild beast was a formidable rival; and the destruction of such was the first employment of heroes. But when he began to multiply, and the arts to accumulate, he soon cleared the plains of the most noxious of these his rivals; a part was taken under his protection and care, while the rest found a precarious refuge in the burning desert, or the howling wilderness.

---

[1] Goldsmith is here unfortunate in his illustration. It so happens that most of the generic and specific distinctions in the mammalia are founded on the teeth. Buttons on the clothes may serve to distinguish the tailor, but in no case *the man*.

[1] While the inferior races of animals seem to have changed as little in any respect since the beginning of human records, as the trees and herbs of the thickets which give many of them shelter, the condition of man himself has fluctuated, and, on the whole, progressed, in a very remarkable manner. The inferior animals were formed by their Creator such, that, within one life or generation, they should attain all the perfection of which their nature was susceptible. Their wants were either immediately provided for—as instanced in the clothing of feathers to birds, and of furs to quadrupeds; or were so few and simple, that the supply was easy to very limited powers—except in a few cases where considerable art was required, as by the bee in making its honey-cell, or by the bird in constructing its beautiful nest, and there, a peculiar aptitude or instinct was bestowed. Thus a crocodile which issues from its egg in the warm sand, and never sees its parent, becomes as perfect as

From being rivals, quadrupeds have now become the assistants of man; upon them he devolves the most laborious employments, and finds in them patient and humble coadjutors, ready to obey, and content with the smallest retribution. It was not, however, without long and repeated efforts that the independent spirit of these animals was broken; for the savage freedom, in wild animals, is generally found to pass down through several generations before it is totally subdued. Those cats and dogs that are taken from a state of natural wildness in the forest, still transmit their fierceness to their young; and, however concealed in general, it breaks out upon several occasions. Thus the assiduity and application of man in bringing them up, not only alters their disposition, but their very forms; and the difference between animals in a state of nature and domestic tameness, is so considerable, that Mr Buffon has taken this as a principal distinction in classing them.

In taking a cursory view of the form of quadrupeds, we may easily perceive, that of all the ranks of animated nature, they bear the nearest resemblance to man. This similitude will be found more striking when, erecting themselves on their hinder feet, they are taught to walk forward in an upright posture. We then see that all their extremities in a

---

knowing as any crocodile that has lived before or that will appear after it. But how different from this is the story of man! He comes into the world the most helpless of living beings, long to continue so; and if deserted by parents at an early age, so that he can learn only what the experience of one life may teach him—as to a few individuals has happened who yet have attained maturity in woods and deserts—he grows up in some respects inferior to the nobler brutes. Now, as regards many regions of the earth, history exhibits the early human inhabitants in states of ignorance and barbarism, not far removed from this lowest possible grade, which civilized men may shudder to contemplate. But these countries, occupied formerly by straggling hordes of miserable savages, who could scarcely defend themselves against the wild beasts that shared the woods with them, and the inclemencies of the weather, and the consequences of want and fatigue, and who to each other were often more dangerous than any wild beasts, unceasingly warring among themselves, and destroying each other with every species of savage, and even cannibal, cruelty—countries so occupied formerly, are now become the abodes of myriads of peaceful, civilized, and friendly men, where the desert and impenetrable forest are changed into cultivated fields, rich gardens, and magnificent cities. It is the strong intellect of man, operating with the faculty of language as a means, which has gradually wrought this wonderful change. By language, fathers communicated their gathered experience and reflections to their children, and these to succeeding children, with new accumulation: and when, after many generations, the precious store had grown until simple memory could retain no more, the arts of writing, and then of printing, arose, making language visible and permanent, and enlarging illimitably the repositories of knowledge. Language thus, at the present moment of the world's existence, may be said to bind the whole human race of uncounted millions into one gigantic rational being, whose memory reaches to the beginnings of written records, and retains imperishably the important events that have occurred; whose judgment, analyzing the treasures of memory, has discovered many of the sublime and unchanging laws of nature, and has built on them all the arts of life, and through them, piercing far into futurity, sees clearly many of the events that are to come; and whose eyes and ears and observant mind at this moment, in every corner of the earth, are watching and recording new phenomena, for the purpose of still better comprehending the magnificence and beautiful order of creation, and of more worthily adoring its beneficent Author. But there is a change going on in the world, connected closely with the progress of science yet distinct from it, and more important than half of the scientific discoveries—it is the *diffusion of existing knowledge* among the mass of mankind. Formerly knowledge was shut up in convents and universities, and in books written in the dead languages—or in books which, if in the living languages, were so abstruse and artificial, that only a few persons had access to their meaning; and thus, considering the human race as one great intellectual creature, a small fraction only of its intellect was allowed to come in contact with science, and therefore into activity; which fraction, moreover, was often only half exerted, because sufficient motive was wanting. The progress of science in those times was correspondingly slow, and the evils of general ignorance prevailed. Now, however, the strong barriers which confined the stores of wisdom have been thrown down, and a flood overspreads the earth; old establishments are adapting themselves to the spirit of the age; new establishments are arising; the inferior schools are introducing improved systems of instruction; and good books are rendering every man's fire-side a school. From all these causes there is growing up an *enlightened public opinion*, which quickens and directs the progress of every art and science, and through the medium of a free press, although overlooked by many, is more rapidly becoming the governing influence in all the affairs of man. In Great Britain, partly perhaps as a consequence of its insular situation, which lessened among its inhabitants the dread of hostile invasion, and sooner formed them into a united and compact people, the progress of enlightened public opinion has been more decided than in any other state.—*Arnott's Physics.*

manner correspond with ours, and present us with a rude imitation of our own. In some of the ape kind the resemblance is so striking, that anatomists are puzzled to find in what part of the human body man's superiority consists; and scarcely any but the metaphysician can draw the line that divides them.[1]

But if we compare their internal structure with our own, the likeness will be found still to increase, and we shall perceive many advantages they enjoy in common with us, above the lower tribes of nature. Like us, they are placed above the class of birds, by bringing forth their young alive; like us, they are placed above the class of fishes, by breathing through the lungs; like us, they are placed above the class of insects, by having red blood circulating through their veins; and, lastly, like us, they are different from almost all the other classes of animated nature, being either wholly or partly covered with hair. Thus nearly are we represented, in point of conformation, to the class of animals immediately below us; and this shows what little reason we have to be proud of our persons alone, to the perfection of which quadrupeds make such very near approaches.

The similitude of quadrupeds to man obtains also in the fixedness of their nature, and their being less apt to be changed by the influence of climate or food, than the lower ranks of nature. Birds are found very apt to alter both in colour and size; fishes likewise still more; insects may be quickly brought to change and adapt themselves to the climate; and if we descend to plants, which may be allowed to have a kind of living existence, their kinds may be surprisingly and readily altered, and taught to assume new forms. The figure of every animal may be considered as a kind of drapery, which it may be made to put on or off by human assiduity: in man, the drapery is almost invariable; in quadrupeds, it admits of some variation; and the variety may be made greater still, as we descend to the inferior classes of animal existence.

Quadrupeds, although they are thus strongly marked, and in general divided from the various kinds around them, yet some of them are often of so equivocal a nature, that it is hard to tell whether they ought to be ranked in the quadruped class, or degraded to those below them. If, for instance, we were to marshal the whole groupe of animals round man, placing the most perfect next him, and those most equivocal near the classes they most approach, we should find it difficult after the principal had taken their stations near him, where to place many that lie at the outskirts of this phalanx. The bat makes a near approach to the aërial tribe, and might, by some, be reckoned among the birds. The porcupine has not less pretensions to that class, being covered with quills, and showing that birds are not the only part of nature that are furnished with such a defence. The armadillo might be referred to the tribe of insects or snails, being like them covered with a shell; the seal and the morse might be ranked among the fishes, like them being furnished with fins and almost constantly residing in the same element. All these, the farther they recede from the human figure, become less perfect, and may be considered as the lowest kinds of that class to which we have referred them.

But although the variety in quadrupeds is thus great, they all seem well adapted to the stations in which they are placed. There is scarcely one of them, how rudely shaped soever, that is not formed to enjoy a state of happiness fitted to its nature. All its deformities are only relative to us, but all its enjoyments are peculiarly its own. We may superficially suppose the sloth, that takes up months in climbing a single tree, or the mole, whose eyes are too small for distant vision, are wretched and helpless creatures: but it is probable that their life, with respect to themselves, is a life of luxury; the most pleasing food is easily obtained; and as they are abridged in one pleasure, it may be doubled in those which remain. Quadrupeds, and all the lower kind of animals, have, at worst, but the torments of immediate evil to encounter, and this is but transient and accidental: man has two sources of calamity, that which he foresees, as well as that which he feels; so that if his reward were to be in this life alone, then, indeed, would he be of all beings the most wretched.

The heads of quadrupeds, though differing from each other, are, in general, adapted to their way of living. In some it is sharp, the better to fit the animal for turning up the earth in which its food lies. In some it is long, in order to give a greater room for the olfactory nerves, as in dogs, who are to hunt and find out their prey by the scent. In others, it is short and thick, as in the lion, to increase the strength of the jaw, and to fit it the better for combat.[2] In quadrupeds that feed upon grass, they are enabled to hold down their heads to the ground, by a strong tendinous ligament, that runs from the head to the middle of the back. This serves to raise the head, although it has been held to the ground for several hours, without any labour or any assistance from the muscles of the neck.

---

[1] Some writers have argued that brutes have souls, and that their souls are immortal. One of the most curious and instructive treatises on this subject is a small volume, printed at Peterhead in 1824, entitled, "Scriptural and Philosophical Arguments, or Cogent Proofs from Reason and Revelation, that Brutes have Souls, and that their Souls are Immortal. By Peter Buchan."

[2] The great teeth of such quadrupeds as the Hippopotamus require proportioned jaws, and, consequently, the bones of the head are of great strength and weight. Thence arises a necessity for the head being supported

The teeth of all animals are entirely fitted to the nature of their food. Those of such as live upon flesh differ in every respect from such as live upon vegetables. In the latter, they seem entirely made for gathering and bruising their simple food, being edged before, and fitted for cutting; but broad towards the back of the jaw, and fitted for pounding. In the carnivorous kinds, they are sharp before, and fitted rather for holding than dividing. In the one, the teeth serve as grindstones; in the other, as weapons of defence: in both, however, the surface of those teeth which serve for grinding are unequal: the cavities and risings fitting those of the opposite, so as to tally exactly when the jaws are brought together. These inequalities better serve for comminuting the food: but they become smooth with age; and, for this reason, old animals take a longer time to chew their food than such as are in the vigour of life.

Their legs are not better fitted than their teeth to their respective wants or enjoyments. In some they are made for strength only, and to support a vast unwieldy frame, without much flexibility or beautiful proportion. Thus, the legs of the elephant, the rhinoceros, and the sea-horse, resemble pillars: were they made smaller, they would be unfit to support the body; were they endowed with greater flexibility, or swiftness, that would be needless, as they do not pursue other animals for food; and conscious of their own superior strength, there are none that they deign to avoid. Deer, hares, and other creatures, that are to find safety only in flight, have their legs made entirely for speed; they are slender, and nervous. Were it not for this advantage every carnivorous animal would soon make them a prey, and their races would be entirely extinguished. But, in the present state of nature, the means of safety are rather superior to those of offence; and the pursuing animal must owe success only to patience, perseverance, and industry. The feet of some that live upon fish alone, are made for swimming. The toes of these animals are joined together with membranes, being web-footed like a goose or a duck, by which they swim with great rapidity. Those animals that lead a life of hostility, and live upon others, have their feet armed with sharp claws, which some can sheathe, and unsheathe, at will. Those, on the contrary, who lead peaceful lives, have generally hoofs, which serve some as weapons of defence: and which in all are better fitted for traversing extensive tracts of rugged country, than the claw-foot of their pursuers.

The stomach is generally proportioned to the quality of the animal's food, or the ease with which it is obtained. In those that live upon flesh, and such nourishing substances, it is small and glandular, affording such juices as are best adapted to digest its contents; their intestines also are short, and without fatness. On the contrary, such animals as feed entirely upon vegetables, have the stomach very large, and those who chew the cud have no less than four stomachs, all which serve as so many laboratories to prepare and turn their coarse food into proper nourishment. In Africa, where the plants afford greater nourishment than in our temperate climates, several animals, that with us have four stomachs, have there but two.[1] However, in all animals the size of the intestines is proportioned to the nature of the food: where that is furnished in large quantities the stomach dilates to answer the increase. In domestic animals, that are plentifully supplied, it is large; in the wild animals, that live precariously, it is much more contracted, and the intestines are much shorter.

In this manner, all animals are fitted by

---

by a particular ligamentous apparatus, which in the bull is vulgarly called the *paxwax* (the ligamentum muchæ.) This ligament extends from the prominent spines of the vertebræ betwixt the shoulders, to the occiput or back of the head, so as to suspend the head, and of course without muscular exertion or waste of vital energy. This ligament, however, differs from the common ligaments which knit the bones together, in being elastic; without which property it would check the motions of the head. On this subject of the wonderful provisions evinced in the bones of the head and neck of the larger animals, Sir C. Bell, late anatomical Professor in the Royal College of Surgeons, on exhibiting the skull of the elephant, made his audience mark the weight of the grinding teeth, the length of the tusks, and the size and strength of the jaws, and observed it was impossible that such an enormous engine of mastication could be suspended at the end of a long neck. Jockies, he said, attended very particularly to a light head and a short neck on a horse; a heavy head and a long neck brought too great a weight to bear upon the fore-feet. If such slight differences in the shape were observed to produce defects in the horse, the consequent imperfection would be incalculably greater in the elephant. But in this animal, nature, instead of projecting the head on such a neck as would enable the mouth to reach the ground, diminishes the depth of the vertebræ of the neck in a very remarkable manner, so as in fact to fix the head to the body without the intervention of a neck. But how was the animal to feed? since the want of a neck and the projection of the tusks made grazing in the usual way impossible. This implied the necessity of a trunk, which is equivalent to a hand, and enables the animal to feed itself without projecting the head to the ground. By these and similar illustrations, the Professor proved design in the structure of the skeleton; and contrasted the heads of the horse, the elephant, and the giraffe.

[1] Buffon.

nature to fill up some peculiar station.[1] The greatest animals are made for an inoffensive life, to range the plains and the forest without injuring others; to live upon the productions of the earth, the grass of the field, or the tender branches of trees. These, secure in their own strength, neither fly from any other quadrupeds, nor yet attack them: Nature to the greatest strength has added the most gentle and harmless dispositions: without this, those enormous creatures would be more than a match for all the rest of the creation; for what devastation might not ensue, were the elephant, or the rhinoceros, or the buffalo, as fierce and as mischievous as the tiger or the rat? In order to oppose these larger animals, and in some measure to prevent their exuberance, there is a species of the carnivorous kind, of inferior strength indeed, but of greater activity and cunning. The lion and the tiger generally watch for the larger kinds of prey, attack them at some disadvantage, and commonly jump upon them by surprise. None of the carnivorous kinds, except the dog alone, will make a voluntary attack, but with the odds on their side. They are all cowards by nature, and usually catch their prey by a bound from some lurking-place, seldom attempting to invade them openly; for the larger beasts are too powerful for them, and the smaller too swift.

A lion does not willingly attack a horse, and then only when compelled by the keenest hunger. The combats between a lion and a horse are frequent enough in Italy; where they are both enclosed in a kind of amphitheatre, fitted for the purpose. The lion always approaches wheeling about, while the horse presents his hinder parts to the enemy. The lion in this manner goes round and round, still narrowing his circle, till he comes to the proper distance to make his spring; just at the time the lion springs, the horse lashes with both legs from behind, and, in general, the odds are in his favour; it more often happening that the lion is stunned, and struck motionless by the blow, than that he effects his jump between the horse's shoulders. If the lion is stunned, and left sprawling, the horse escapes, without attempting to improve his victory; but if the lion succeeds, he sticks to his prey, and tears the horse in pieces, in a very short time.

But it is not among the larger animals of the forest alone, that these hostilities are carried on; there is a minuter, and a still more treacherous contest, between the lower ranks of quadrupeds. The panther hunts for the sheep and the goat; the catamountain for the hare or the rabbit; and the wild cat for the squirrel or the mouse. In proportion as each carnivorous animal wants strength, it uses all the assistance of patience, assiduity, and cunning. However, the arts of these to pursue, are not so great as the tricks of their prey to escape; so that the power of destruction in one class, is inferior to the power of safety in the other. Were this otherwise, the forest would soon be dispeopled of the feebler races of animals; and beasts of prey themselves would want, at one time, that subsistence which they lavishly destroyed at another.

Few wild animals seek their prey in the day-time; they are then generally deterred by their fears of man in the inhabited countries, and by the excessive heat of the sun in those extensive forests that lie towards the south, and in which they reign the undisputed tyrants. As soon as the morning, therefore, appears, the carnivorous animals retire to their dens; and the elephant, the horse, the deer, and all the hare kinds, those inoffensive tenants of the plain, make their appearance. But again, at night-fall, the state of hostility begins; the whole forest then echoes to a variety of different howlings. Nothing can be more terrible than an African landscape at the close of evening; the deep-toned roarings of the lion; the shriller yellings of the tiger; the jackal, pursuing by the scent, and barking like a dog; the hyena, with a note peculiarly solitary and dreadful; but, above all, the hissing of the various kinds of serpents, that then begin their call, and, as I am assured, make a much louder symphony than the birds in our groves in a morning.

Beasts of prey seldom devour each other; nor can any thing but the greatest degree of hunger induce them to it. What they chiefly seek after, is the deer, or the goat; those harmless creatures, that seem made to embellish nature. These are either pursued or surprised, and afford the most agreable repast to their destroyers. The most usual method with even the fiercest animals, is to hide and crouch near some path frequented by their prey; or some water where cattle come to drink; and seize them at once with a bound. The lion and the tiger leap twenty feet at a spring; and this, rather than their swiftness or strength, is what they have most to depend upon for a supply. There is scarcely one of the deer or hare kind, that is not very easily capable of escaping them by its swiftness; so that whenever any of these fall a prey, it must be owing to their own inattention.

But there is another class of the carnivorous kind, that hunt by the scent, and which it is much more difficult to escape. It is remarkable, that all animals of this kind pursue in a pack; and encourage each other by their mutual cries. The jackal, the syagush, the wolf, and the dog, are of this kind; they pursue with patience rather than swiftness: their prey flies at first, and leaves them for miles behind; but they keep on with a constant steady pace, and excite each other by a general spirit of industry and emulation, till at last they share the common plunder. But it too often happens, that the larger beasts of prey, when they hear a cry of this kind begin, pursue the pack, and when they have hunted down the animal, come in and monopolize the spoil. This has given rise to the report of the jackal's being the lion's provider; when the reality is, that the jackal hunts for itself, and the lion is an unwelcome intruder upon the fruit of his toil.

---

[1] This, and many other points treated of in the present chapter, will come to be more fully illustrated in the course of the work.

Nevertheless, with all the powers which carnivorous animals are possessed of, they generally lead a life of famine and fatigue. Their prey has such a variety of methods for escaping, that they sometimes continue without food for a fortnight together: but nature has endowed them with a degree of patience equal to the severity of their state; so that as their subsistence is precarious, their appetites are complying. They usually seize their prey with a roar, either of seeming delight, or perhaps to terrify it from resistance. They frequently devour it, bones and all, in the most ravenous manner; and then retire to their dens, continuing inactive, till the calls of hunger again excite their courage and industry. But as all their methods of pursuit are counteracted by the arts of evasion, they often continue to range without success, supporting a state of famine for several days, nay, sometimes, weeks together. Of their prey, some find protection in holes, in which nature has directed them to bury themselves; some find safety by swiftness; and such as are possessed of neither of these advantages, generally herd together, and endeavour to repel invasion by united force. The very sheep, which to us seem so defenceless, are by no means so in a state of nature; they are furnished with arms of defence, and a very great degree of swiftness; but they are still further assisted by their spirit of mutual defence: the females fall into the centre; and the males, forming a ring round them, oppose their horns to the assailants. Some animals, that feed upon fruits which are to be found only at one time of the year, fill their holes with several sorts of plants, which enable them to lie concealed during the hard frosts of the winter, contented with their prison, since it affords them plenty and protection. These holes are dug with so much art, that there seems the design of an architect in the formation. There are usually two apertures, by one of which the little inhabitant can always escape, when the enemy is in possession of the other. Many creatures are equally careful of avoiding their enemies, by placing a sentinel to warn them of the approach of danger. These generally perform this duty by turns; and they know how to punish such as have neglected their post, or have been unmindful of the common safety. Such are a part of the efforts that the weaker races of quadrupeds exert to avoid their invaders; and, in general, they are attended with success. The arts of instinct are most commonly found an over-match for the invasions of instinct. Man is the only creature against whom all their little tricks cannot prevail. Wherever he has spread his dominion, scarcely any flight can save, or any retreat harbour; wherever he comes, terror seems to follow, and all society ceases among the inferior tenants of the plain; their union against him can yield them no protection, and their cunning is but weakness. In their fellow-brutes, they have an enemy whom they can oppose with an equality of advantage: they can oppose fraud or swiftness to force, or numbers to invasion; but what can be done against such an enemy as man, who finds them out though unseen; and though remote, destroys them? Wherever he comes, all the conquests among the meaner ranks seem to be at an end, or are carried on only by surprise. Such as he has thought proper to protect, have calmly submitted to his protection; such as he has found it convenient to destroy, carry on an unequal war, and their numbers are every day decreasing.

The wild animal is subject to few alterations; and, in a state of savage nature, continues for ages the same, in size, shape, and colour. But it is otherwise when subdued, and taken under the protection of man; its external form, and even its internal structure, are altered by human assiduity; and this is one of the first and greatest causes of the variety that we see among the several quadrupeds of the same species. Man appears to have changed the very nature of domestic animals, by cultivation and care. A domestic animal is a slave that seems to have few other desires but such as man is willing to allow it. Humble, patient, resigned, and attentive, it fills up the duties of its station; ready for labour, and content with subsistence.

Almost all domestic animals seem to bear the marks of servitude strong upon them. All the varieties in their colour, all the fineness and length of their hair, together with the depending length of their ears, seem to have arisen from a long continuance of domestic slavery.—What an immense variety is there to be found in the ordinary race of dogs and horses! the principal differences of which have been effected by the industry of man, so adapting the food, the treatment, the labour, and the climate, that Nature seems almost to have forgotten her original design; and the tame animal no longer bears any resemblance to its ancestors in the woods around him.

In this manner, nature is under a kind of constraint, in those animals we have taught to live in a state of servitude near us. The savage animals preserve the marks of their first formation; their colours are generally the same; a rough dusky brown, or a tawny, seem almost their only varieties. But it is otherwise in the tame; their colours are various, and their forms different from each other. The nature of the climate indeed operates upon all; but more particularly on these. That nourishment which is prepared by the hand of man, not adapted to their appetites, but to suit his own convenience; that climate, the rigours of which he can soften; and that employment to which they are sometimes assigned; produce a number of distinctions that are not to be found among the savage animals. These, at first, were accidental, but in time became hereditary; and a new race of artificial monsters are propagated, rather to answer the purposes of human pleasure than their own convenience. In short, their very appetites may be changed; and those that feed only upon grass may be rendered carnivorous. I have seen a sheep that would eat flesh, and a horse that was fond of oysters.

But not their appetites, or their figure alone, nay their very dispositions, and their natural sagacity, are altered by the vicinity of man. In those countries where men have seldom intruded, some animals have been found, established in a kind of civil state of society. Remote from the tyranny of man, they seem to have a spirit of mutual benevolence, and mutual friendship. The beavers, in those distant solitudes, are known to build like architects, and rule like citizens. The habitations that these have been seen to erect, exceed the houses of the human inhabitants of the same country, both in neatness and convenience. But as soon as man intrudes upon their society, they seem impressed with the terrors of their inferior situation, their spirit of society ceases, the bond is dissolved and every animal looks for safety in solitude, and there tries all its little industry to shift only for itself.

Next to human influence, the climate seems to have the strongest effects both upon the nature and the form of quadrupeds. As in man we have seen some alterations produced by the variety of his situation; so in the lower ranks, that are more subject to variation, the influence of climate is more readily perceived. As these are more nearly attached to the earth, and in a manner connected to the soil; as they have none of the arts of shielding off the inclemency of the weather, or softening the rigours of the sun, they are consequently more changed by its variations. In general it may be remarked, that the colder the country, the larger and the warmer is the fur of each animal; it being wisely provided by Nature, that the inhabitant should be adapted to the rigours of its situation. Thus the fox and wolf, which in temperate climates have but short hair, have a fine long fur in the frozen regions near the pole. On the contrary, those dogs which with us have long hair, when carried to Guinea, or Angola, in a short time cast their thick covering, and assume a lighter dress, and one more adapted to the warmth of the country. The beaver, and the ermine, which are found in the greatest plenty in the cold regions, are remarkable for the warmth and delicacy of their furs; while the elephant and the rhinoceros, that are natives of the line, have scarcely any hair. Not but that human industry can, in some measure, co-operate with, or repress, the effects of climate in this particular. It is well known what alterations are produced, by proper care, in the sheep's fleece in different parts of our country; and the same industry is pursued with a like success in Syria, where many of their animals are clothed with a long and beautiful hair, which they take care to improve, as they work it into that stuff called camblet, so well known in different parts of Europe.

The disposition of the animal seems also not less marked by the climate than the figure. The same causes that seem to have rendered the human inhabitants of the rigorous climates savage and ignorant, have also operated upon their animals. Both at the line and the pole, the wild quadrupeds are fierce and untameable. In these latitudes, their savage dispositions having not been quelled by any efforts from man, and being still farther stimulated by the severity of the weather, they continue fierce and untractable. Most of the attempts which have hitherto been made to tame the wild beasts brought home from the pole or the equator, have proved ineffectual. They are gentle and harmless enough while young; but as they grow up, they acquire their natural ferocity, and snap at the hand that feeds them. It may indeed, in general, be asserted, that in all countries where the men are most barbarous, the beasts are most fierce and cruel; and this is but a natural consequence of the struggle between man and the more savage animals of the forest; for in proportion as he is weak and timid, they must be bold and intrusive; in proportion as his dominion is but feebly supported, their capacity must be more obnoxious. In the extensive countries, therefore, lying round the pole, or beneath the line, the quadrupeds are fierce and formidable. Africa has ever been remarked for the brutality of its men, and the fierceness of its animals: its lions and its leopards are not less terrible than its crocodiles and its serpents; their dispositions seem entirely marked with the rigours of the climate, and being bred in an extreme of heat, they show a peculiar ferocity, that neither the force of man can conquer, nor his arts allay. However, it is happy for the wretched inhabitants of those climates, that its most formidable animals are all solitary ones; that they have not learned the art of uniting, to oppress mankind; but each depending on its own strength, invades without any assistant.

The food also is another cause of the variety which we find among quadrupeds of the same kind. Thus the beasts which feed in the valley are generally larger than those which glean a scanty subsistence on the mountain. Such as live in the warm climates, where the plants are much larger and more succulent than with us, are equally remarkable for their bulk. The ox fed in the plains of Indostan, is much larger than that which is more hardily maintained on the side of the Alps. The deserts of Africa, where the plants are extremely nourishing, produce the largest and fiercest animals; and, perhaps for a contrary reason, America is found not to produce such large animals as are seen in the ancient continent. But, whatever be the reason, the fact is certain, that while America exceeds us in the size of its reptiles of all kinds, it is far inferior in its quadruped productions. Thus, for instance, the largest animal of that country is the tapir, which can by no means be compared to the elephant of Africa. Its beasts of prey, also, are divested of that strength and courage which is so dangerous in this part of the world. The American lion, tiger, and leopard, if such diminutive creatures deserve these names, are neither so fierce nor so valiant as those of Africa and Asia. The tiger of Bengal has been seen to measure twelve feet in length, without including the tail: whereas the American tiger seldom exceeds three. This difference obtains still more in the other animals of that country, so that some have been of opinion[1] that all quadrupeds in Southern America are of a different species from those most resembling them in the old world; and that there are none which are common to both, but such as have entered America by the north; and which, being able to bear the rigours of the frozen pole, have travelled from the ancient continent, by that passage, into the new. Thus the bear, the wolf, the elk, the stag, the fox, and the beaver, are known to the inhabitants as well of North America as of Russia; while most of the various kinds to the southward, in both continents, bear no resemblance to each other. Upon the whole, such as peculiarly belong to the new continent are without any marks of the quadruped perfection. They are almost wholly destitute of the power of defence; they have neither formidable teeth, horns, or tail; their figure is awkward, and their limbs ill proportioned. Some among them, such as the ant-bear and the sloth, appear so miserably formed, as scarcely to have the power of moving and eating. They, seemingly, drag out a miserable and languid existence in the most desert solitude; and would quickly have been destroyed in a country where there were inhabitants, or powerful beasts to oppose them.

But if the quadrupeds of the new continent be less, they are found in much greater abundance; for it is a rule that obtains through nature, that the smallest animals multiply the fastest. The goat, imported from Europe to South America, soon begins to degenerate; but as it grows less it becomes more prolific; and, instead of one kid at a time, or two at the most, it generally produces five, and sometimes more. What there is in the food, or the climate, that produces this change, we have not been able to learn; we might be apt to ascribe it to the heat, but that on the African coast, where it is still hotter, this rule does not obtain; for the goat, instead of degenerating there, seems rather to improve.

However, the rule is general among quadrupeds, that those which are large and formidable produce but few at a time; while such as are mean and contemptible are extremely prolific. The lion, or tiger, have seldom above two cubs at a litter; while the cat, that is of a similar nature, is usually seen to have five or six. In this manner the lower tribes become extremely numerous; and, but for this surprising fecundity, from their natural weakness they would quickly be extirpated. The breed of mice, for instance, would have long since been blotted from the earth, were the mouse as slow in production as the elephant. But it has been wisely provided, that such animals as can make but little resistance, should at least have a means of repairing the destruction, which they must often suffer, by their quick reproduction; that they should increase even among enemies, and multiply under the hand of the destroyer. On the other hand, it has as wisely been ordered by Providence, that the larger kinds should produce but slowly; otherwise, as they require proportional supplies from nature, they would quickly consume their own store; and, of consequence, many of them would soon perish through want; so that life would thus be given without the necessary means of subsistence. In a word, Providence has most wisely balanced the strength of the great against the weakness of the little. Since it was necessary that some should be great and others mean, since it was expedient that some should live upon others, it has assisted the weakness of one by granting it fruitfulness; and diminished the number of the other in fecundity.

---

[1] Buffon.

In consequence of this provision, the larger creatures, which bring forth few at a time, seldom begin to generate till they have nearly acquired their full growth. On the contrary, those which bring forth many, reproduce before they have arrived at their natural size. Thus the horse and the bull are nearly at their best before they begin to breed; the hog and the rabbit scarcely leave the teat before they become parents in turn. Almost all animals likewise continue the time of their pregnancy in proportion to their size. The mare continues eleven months with foal, the cow nine, the wolf five, and the bitch nine weeks. In all, the intermediate litters are the most fruitful; the first and the last generally producing the fewest in number, and the worst of the kind.

Whatever be the natural disposition of animals at other times, they all acquire new courage when they consider themselves as defending their young. No terrors can then drive them from the post of duty; the mildest begin to exert their little force, and resist the most formidable enemy. Where resistance is hopeless, they then incur every danger, in order to rescue their young by flight, and retard their own expedition by providing for their little ones. When the female oppossum, an animal of America, is pursued, she instantly takes her young into a false belly, with which nature has supplied her, and carries them off, or dies in the endeavour. I have been lately assured of a she-fox, which, when hunted, took her cub in her mouth, and ran for several miles without quitting it, until at last she was forced to leave it behind, upon the approach of a mastiff, as she ran through a farmer's yard. But, if at this period the mildest animals acquire new fierceness, how formidable must those be that subsist by rapine! At such times, no obstacles can stop their ravages, nor no threats can terrify; the lioness then seems more hardy than even the lion himself. She attacks men and beasts indiscriminately, and carries all she can overcome reeking to her cubs, whom she thus early accustoms to slaughter. Milk, in the carnivorous animals, is much more sparing than in others; and it may be for this reason that all such carry home their prey alive, that, in feeding their young, its blood may supply the deficiencies of nature, and serve instead of that milk with which they are so sparingly supplied.

Nature, that has thus given them courage to defend their young, has given them instinct to choose the proper times of copulation, so as to bring forth when the provision suited to each kind is to be found in the greatest plenty. The wolf, for instance, couples in November, so that the time of pregnancy continuing five months, it may have its young in April. The mare, who goes eleven months, admits the horse in summer, in order to foal about the beginning of May. On the contrary, those animals which lay up provisions for the winter, such as the beaver and the marmotte, couple in the latter end of autumn, so as to have their young about January, against which season they have provided a very comfortable store. These seasons for coupling, however, among some of the domestic kinds, are generally in consequence of the quantity of provisions with which they are at any time supplied. Thus we may, by feeding any of these animals, and keeping off the rigour of the climate, make them breed whenever we please. In this manner those contrive who produce lambs all the year round.

The choice of situation in bringing forth is also very remarkable. In most of the rapacious kinds, the female takes the utmost precautions to hide the place of her retreat from the male; who otherwise, when pressed by hunger, would be apt to devour her cubs. She seldom, therefore, strays far from the den, and never approaches it while he is in view, nor visits him again till her young are capable of providing for themselves. Such animals as are of tender constitutions take the utmost care to provide a place of warmth, as well as safety, for their young; the rapacious kinds bring forth in the thickest woods; those that chew the cud, with the various tribes of the vermin kind, choose some hiding place in the neighbourhood of man. Some dig holes in the ground; some choose the hollow of a tree; and all the amphibious kinds bring up their young near the water, and accustom them betimes to their proper element.

Thus Nature seems kindly careful for the protection of the meanest of her creatures: but there is one class of quadrupeds that seems entirely left to chance, that no parent stands forth to protect, nor no instructor leads, to teach the arts of subsistence. These are the quadrupeds that are brought forth from the egg, such as the lizard, the tortoise, and the crocodile. The fecundity of all other animals compared with these is sterility itself. These bring forth above two hundred at a time; but, as the offspring is more numerous, the parental care is less exerted. Thus the numerous brood of eggs are, without farther solicitude, buried in the warm sands of the shore, and the heat of the sun alone is left to bring them to perfection. To this perfection they arrive almost as soon as disengaged from the shell. Most of them, without any other guide than instinct, immediately make to the water. In their passage thither, they have numberless enemies to fear. The birds of prey that haunt the shore, the beasts that accidentally come there, and even the animals that give them birth, are known, with a strange rapacity, to thin their numbers as well as the rest.

But it is kindly ordered by Providence, that these animals which are mostly noxious, should thus have many destroyers: were it not for this, by their extreme fecundity, they would soon overrun the earth, and cumber all our plains with deformity.

A HISTORY OF ANIMALS.

BOOK I.

ANIMALS OF THE HORSE KIND.

CHAP. I.

OF THE HORSE.[1]

ANIMALS of the horse kind deserve a place next to man, in a history of nature. Their activity, their strength, their usefulness, and their beauty, all contribute to render them the principal objects of our curiosity and care; a race of creatures in whose welfare we are interested next to our own.

Of all the quadruped animals the horse seems the most beautiful: the noble largeness of his form, the glossy smoothness of his skin, the graceful ease of his motions, and the exact symmetry of his shape, have taught us to regard him as the first, and as the most perfectly formed; and yet, what is extraordinary enough, if we examine him internally, his structure will be found the most different from that of man of all other quadrupeds whatsoever. As the ape approaches us the nearest in internal conformation, so the horse is the most remote;[2] a striking proof that there may be oppositions of beauty, and that all grace is not to be referred to one standard.

To have an idea of this noble animal in his native simplicity, we are not to look for him in the pastures or the stables to which he has been consigned by man; but in those wild and extensive plains where he has been originally produced; where he ranges without control, and riots in all the variety of luxurious nature. In this state of happy independence, he disdains the assistance of man, which only tends to servitude. In those boundless tracts, whether of Africa or New Spain, where he runs at liberty, he seems no way incommoded with the inconveniences to which he is subject in Europe. The continual verdure of the fields supplies his wants; and the climate, that never knows a winter, suits his constitution, which naturally seems adapted to heat. His enemies of the forest are but few, for none but the greater kind will venture to attack him: any one of these he is singly able to overcome; while, at the same time, he is content to find safety in society; for the wild horses of those countries always herd together.

In these countries, therefore, the horses are often seen feeding in droves of five or six hundred. As they do not carry on war against any other race of animals, they are satisfied to remain entirely upon the defensive. The pastures on which they live satisfy all their appetites, and all other precautions are purely for their security, in case of a surprise. As they are never attacked but at a disadvantage, whenever they sleep in the forests, they have always one among their number that stands as centinel, to give notice of any approaching danger; and this office they take by turns.[1] If a man approaches them while they are feeding by day, their sentinel walks up boldly near him, as if to examine his strength, or to intimidate him from proceeding; but as the man approaches within pistol-shot, the centinel then thinks it high time to alarm his fellows; this he does by a loud kind of snorting, upon which they all take the signal, and fly off with the speed of the wind; their faithful centinel bringing up the rear.[2]

---

[1] As it may happen, than in a description where it is the aim rather to insert what is not usually known, than all that is known, some of the more obvious particulars may be omitted; I will take leave to subjoin in the notes the characteristic marks of each animal, as given us by Linnæus. "The horse, with six cutting teeth before, and singled hoofed; a native of Europe and the East (but I believe rather of Africa); a generous, proud, and strong animal; fit either for the draught, the course, or the road; he is delighted with woods; he takes care of his hinder parts; defends himself from the flies with his tail; scratches his fellow; defends his young; calls by neighing; sleeps after night-fall; fights by kicking, and by biting also; rolls on the ground when he sweats; eats the grass closer than the ox; distributes the seed by dunging; wants a gall bladder; never vomits; the foal is produced with the feet stretched out; he is injured by being struck on the ear; upon the stiffle; by being caught by the nose in barnacles; by having his teeth rubbed with tallow; by the herb padus; by the herb phalandria; by the cruculio; by the conops. His diseases are different in different countries. A consumption of the ethmoid bones of the nose, called the *glanders*, is with us the most infectious and fatal. He eats hemlock without injury. The mare goes with foal 290 days. The placenta is not fixed. He acquires not the canine teeth till the age of five years."—*Note by Goldsmith.*

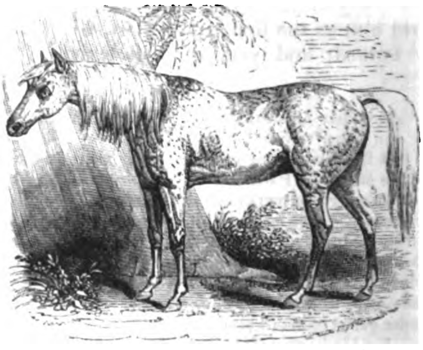
[2] Histoire Naturelle, Daubenton, vol. iii. p. 374.

It is not easy to say from what country the horse came originally. It should seem that the colder climates do not agree with his constitution; for although he is found almost in them all, yet his form is altered there, and he is found at once diminutive and ill-shaped. We have the testimony of the ancients that there were wild horses once in Europe; at present, however, they are totally brought under subjection; and even those which are found in America are of a Spanish breed, which being sent thither upon its first discovery, have since become wild, and have spread over all the south of that vast continent almost to the straits of Magellan. These, in general, are a small breed, of about fourteen hands high. They have thick jaws and clumsy joints; their ears and neck also are long; they are easily tamed; for the horse, by nature, is a gentle complying creature, and resists rather from fear than obstinacy. They are caught by a kind of noose, and then held fast by the legs, and tied to a tree, where they are left for two days without food or drink. By that time they begin to grow manageable; and in some weeks they become as tame as if they had never been in a state of wildness. If, by any accident, they are once more set at liberty, they never become wild again, but know their masters, and come to their call. Some of the buccaniers have often been agreeably surprised, after a long absence, to see their faithful horses once more present themselves, with their usual assiduity; and come up, with fond submission, to receive the rein.

These American horses, however, cannot properly be ranked among the wild races, since they were originally bred from such as were tame. It is not in the new, but the old world, that we are to look for this animal, in a true state of nature; in the extensive deserts of Africa, in Arabia, and those wide-spread countries that separate Tartary from the more southern nations. Vast droves of these animals are seen wild among the Tartars; they are of a small breed, extremely swift, and very readily evade their pursuers. As they go together, they will not admit of any strange animals among them, though even of their own kind. Whenever they find a tame horse attempting to associate with them, they instantly gather round him, and soon oblige him to seek safety by flight. There are vast numbers also of wild horses to the north of China, but they are of a weak, timid breed, small of stature, and useless in war.

At the Cape of Good Hope there are numbers of horses in a state of nature, but small, vicious, and untameable. They are found wild also in several other parts of Africa; but the wretched inhabitants of that country either want the art to tame them, or seem ignorant of their uses. It is common with the negroes, who are carried over from thence to America, when they first see a horse, to testify both terror and surprise. These poor men seem not to have any knowledge of such a creature; and, though the horse is probably a native of their own country, they have let all the rest of mankind enjoy the benefit of his services without turning them to any advantage at home. In some parts of Africa, therefore, where the horse runs wild, the natives seem to consider him rather in the light of a dainty for food, than a useful creature, capable of assisting them either in war or in labour: riding seems a refinement that the natives of Angola or Caffraria have not as yet been able to attend to; and whenever they catch a horse, it is only with an intent to eat him.

But of all countries in the world, where the horse runs wild, Arabia produces the most beautiful breed, the most generous, swift, and persevering. They are found, though not in great numbers, in the deserts of that country; and the natives use every stratagem to take them. Although they are active and beautiful, yet they are not so large as those that are bred up tame; they are of a brown colour, their mane and tail very short, and the hai black and tufted.[3] Their swiftness is incred



---

[1] Dictionnaire Universelle des Animaux, p. 19.

[2] Labat, tom. vii.

[3] Marm. Descript. de l', Afrique, lib. i. p. 51.

ible; the attempt to pursue them in the usual manner of the chase, with dogs, would be entirely fruitless. Such is the rapidity of their flight, that they are instantly out of view, and the dogs themselves give up the vain pursuit. The only method, therefore, of taking them is by traps hidden in the sand, which entangling their feet, the hunter at length comes up, and either kills them, or carries them home alive. If the horse be young, he is considered among the Arabians as a very great delicacy; and they feast upon him while any part is found remaining: but if, from his shape or vigour, he promises to be serviceable in his more noble capacity, they take the usual methods of taming him, by fatigue and hunger, and he soon becomes a useful domestic animal.

The usual manner of trying their swiftness is by hunting the ostrich: the horse is the only animal whose speed is comparable to that of this creature, which is found in the sandy plains, with which those countries abound. The instant the ostrich perceives itself aimed at, it makes to the mountains, while the horseman pursues with all the swiftness possible, and endeavours to cut off its retreat. The chase then continues along the plain, while the ostrich makes use of both legs and wings to assist its motion. However, a horse of the first speed is able to outrun it; so that the poor animal is then obliged to have recourse to art, to elude the hunter, by frequently turning: at length, finding all escape hopeless, it hides its head wherever it can, and suffers itself tamely to be taken. If the horse, in a trial of this kind, shows great speed, and is not readily tired, his price becomes proportionably great, and there are some horses valued at a thousand ducats.

But the horses thus caught, or trained in this manner, are at present but very few; the value of Arabian horses all over the world, has, in a great measure, thinned the deserts of the wild breed; and there are very few to be found in those countries, except such as are tame. The Arabians, as we are told by historians, first began the management of horses in the time of Shaque Ishmael. Before that, they wandered wild along the face of the country neglected and useless; but the natives then first began to tame their fierceness, and to improve their beauty; so that at present they possess a race of the most beautiful horses in the world, with which they drive a trade, and furnish the stables of princes at immense prices.

There is scarcely an Arabian, how poor soever, but is provided with his horse.[1] They, in general, make use of mares in their ordinary excursions; experience has taught them that they support fatigue, thirst, and hunger, better than the horses are found to do. They are also less vicious, of a gentler nature, and are not so apt to neigh. They are more harmless also among themselves, not so apt to kick or hurt each other, but remain whole days together without the least mischief. The Turks, on the contrary, are not fond of mares; and the Arabians sell them such horses as they do not choose to keep for stallions at home. They preserve the pedigree of their horses with great care, and for several ages back. They know their alliances, and all their genealogy; they distinguish the races by different names, and divide them into three classes. The first is that of the nobles, the ancient breed, and unadulterated on either side; the second is that of the horses of the ancient race, but adulterated; and the third is that of the common and inferior kind: the last they sell at a low price; but those of the first class, and even of the second, amongst which are found horses of equal value to the former, are sold extremely dear. They know, by long experience, the race of a horse by his appearance; they can tell the name, the surname, the colour, and the marks properly belonging to each. When they are not possessed of stallions of the noble race themselves, for their mares, they borrow from their neighbours, paying a proper price, as with us, and receive a written attestation of the whole. In this attestation is contained the name of the horse and the mare, and their respective genealogies. When the mare has produced her foal new witnesses are called, and a new attestation signed, in which are described the marks of the foal, and the day noted when it was brought forth. These attestations increase the value of the horse; and they are given to the person who buys him. The most ordinary mare of this race sells for five hundred crowns; there are many that sell for a thousand; and some of the very finest kinds for fourteen or fifteen hundred pounds. As the Arabians have no other house but a tent to live in, this also serves them for a stable; so that the mare, the foal, the husband, the wife, and the children, lie all together indiscriminately; the little children are often seen upon the body or the neck of the mare, while these continue inoffensive and harmless, permitting them thus to play with and caress them without any injury. The Arabians never beat their horses: they treat them gently; they speak to them, and seem to hold a discourse; they use them as friends; they never attempt to increase their speed by the whip, nor spur them, but in cases of necessity. However, when this happens, they set off with amazing swiftness; they leap over obstacles with as much agility as a buck;

---

[1] Buffon.

and if the rider happens to fall, they are so manageable that they stand still in the midst of their most rapid career. The Arabian horses are of a middle size, easy in their motions, and rather inclined to leanness than fat. They are regularly dressed every morning and evening, and with such care that the smallest roughness is not left upon their skins. They wash the legs, the mane, and the tail, which they never cut; and which they seldom comb, lest they should thin the hair. They give them nothing to eat during the day; they only give them to drink once or twice; and at sun-set they hang a bag to their heads in which there is about half a bushel of clean barley. They continue eating the whole night, and the bag is again taken away the next morning. They are turned out to pasture in the beginning of March, when the grass is pretty high, and at which time the mares are given to the stallion. When the spring is past, they take them again from pasture, and they get neither grass nor hay during the rest of the year; barley is their only food, except now and then a little straw. The mane of the foal is clipped when about a year or eighteen months old, in order to make it stronger and thicker. They begin to break them at two years old, or two years and a half at farthest; they never saddle nor bridle them till at that age; and then they are always kept ready saddled at the door of the tent, from morning till sun-set, in order to be prepared against any surprise. They at present seem sensible of the great advantage their horses are to the country; there is a law, therefore, that prohibits the exportation of the mares; and such stallions as are brought into England are generally purchased on the eastern shores of Africa, and come round to us by the Cape of Good Hope. They are in general less in stature than our own, being not above fourteen, or fourteen hands and a half high: their motions are much more graceful and swifter than of our own horses; but nevertheless, their speed is far from being equal; they run higher from the ground; their stroke is not so long and close; and they are far inferior in bottom. Still, however, they must be considered as the first and finest breed in the world, and that from which all others have derived their principal qualifications. It is even probable that Arabia is the original country of horses; since there, instead of crossing the breed, they take every precaution to keep it entire. In other countries they must continually change the races, or their horses would soon degenerate; but there the same blood has passed down through a long succession, without any diminution either of force or beauty.

The race of Arabian horses has spread itself into Barbary among the Moors, and has even extended across that extensive continent to the western shores of Africa. Among the negroes of Gambia and Senegal, the chiefs of the country are possessed of horses, which, though little, are very beautiful, and extremely manageable. Instead of barley, they are fed in those countries with maise bruised and reduced into meal, and mixed up with milk when they design to fatten them. These are considered as next to the Arabian horses, both for swiftness and beauty; but they are still rather smaller than the former. The Italians have a peculiar sport, in which horses of this breed run against each other. They have no riders, but saddles so formed as to flap against the horses' sides as they move, and thus to spur them forward.[1] They are set to run in

---

[1] Horse-racing forms one of the principal amusements of the carnival at Rome. The common people, perhaps, do not take so much delight in any other pastime of that gay season. A Roman horse-race is, however, a very different thing from an English one. Instead of a contest in which the skill and boldness of man are as much to be admired as the speed and vigour of the animal he rides, the Roman course presents nothing but the horse which runs without any rider. It is not, however, left entirely to its own spirit and emulation; if it were, the sight would be more interesting, as showing the natural character of the animal; but it is started by noise, and goaded on by contrivances quite as artificial as the whip and spur of our jockeys.

The barberi, (barbs—so called, perhaps, because the first horses thus employed were of the Barbary breed,) when brought to the starting-post, are gaily ornamented in the front of the head, and sometimes down the neck, with plumes of peacock and other feathers. To a girth which goes round the body of each, are attached several loose straps which have at their ends small balls of lead from which issue sharp steel points,—the motion imparted to these straps by the animals' running keeps up a continual spurring on their flanks and bellies. Sheets of thin tin, stiff paper or some other substance that will make a rustling or rattling noise when agitated, are also fastened on the horses' backs.

The last mentioned articles serve to startle and alarm them, as if the prickly leaden balls were not excitement enough. The rearing, kicking, pawing, and snorting they make, when thus equipped, may be easily conceived. This is seen, in a very striking manner, when the horses are just about to start in the race. A very strong rope, secured by a machine on each side, is drawn across the street of the Corso, and up to this each man tries to bring his horse, holding it in, with all his might, by the head. The Trasteverini, and many of the peasantry in the neighbourhood of Rome are remarkably fine, muscular men; and as they generally go to work with their arms and necks bare, and as they have frequently to maintain a struggle of downright strength with their excited horses, the action of their limbs and muscles, and other circumstances, offer a useful exhibition to the sculptor or painter. Though there are no riders, human life is more endangered in these than in our races. Sometimes the horse masters his groom, and breaks away before the Corso is cleared of people, in which and in several other cases, serious accidents are almost sure to happen.

When matters are ready, a troop of dragoons set off from the other end of the Corso, and go at full gallop towards the starting-post, clearing the way: these soldiers a kind of railed walk, about a mile long, out of which they never attempt to escape; but when they once set forward, they never stop, although the walk from one end to the other is covered with a crowd of spectators, which opens and gives way as the horses approach. Our horses would scarcely, in this manner, face a crowd, and continue their speed without a rider, through the midst of a multitude; and indeed it is a little surprising how in such a place the horses find their own way. However, what our English horses may want in sagacity, they make up by their swiftness; and it has been found upon computation, that their speed is nearly one-fourth greater, even carrying a rider, than that of the swiftest Barb without one.

The Arabian breed has been diffused into Egypt as well as Barbary, and into Persia also; where, as we are told by Marcus Paulus, there are studs of ten thousand white mares all together very fleet, and with the hoof so hard that shoeing is unnecessary.[1] In these countries, they in general give their horses the same treatment that they give in Arabia, except that they litter them upon a bed of their own dung, dried in the sun, and then reduced to powder. When this, which is spread under the horse about five inches thick, is moistened, they dry it again, and spread it as before. The horses of these countries a good deal resemble each other. They are usually of a slender make; their leg fine, bony, and far apart; a thin mane; a fine crest; a beautiful head; the ear small and well pointed; the shoulder thin; the side rounded, without any unsightly prominence; the croup is a little of the longest, and the tail is generally set high. The race of horses, however, is much degenerated in Numidia; the natives having been discouraged from keeping the breed up by the Turks, who seize upon all the good horses, without paying the owners the smallest gratuity for their care in bringing them up. The Tingitanians and Egyptians have now, therefore, the fame of rearing the finest horses, both for size and beauty.[2] The smallest of these last are

---

then retire, and soon after an officer blows a trumpet from a balcony erected near to the spot whence the race is to begin. At the sound of the trumpet, the strong rope stretched across the street drops, the grooms let go their hold, and off start the horses like arrows from a bow. The harder they run, the more they are pricked. Some of them have been known to be so wise as to stop, when the motion of the leaden balls, of course, would cease; but generally they run on at mad career, and *occasionally* show emulation and spite, by catching and biting at each other.

The judge of the race is no less a personage than the Governor of Rome, who stands at a window in the palace of Venice, at which building is the goal or winning-post, or, as the Romans call it, "la ripresa de' barberi." A little beyond this palace the street is shut in with a screen of strong canvas, through which the horses not unfrequently dash, though to their eyes it must look almost like a wall. The prize given to the master of the winning horse is merely an ornamental flag, and a piece of embroidered stuff. During the first six days of the carnival, which at Rome is limited to eight days, matches of mares, barbs, and other horses, are run alternately; but during the two last days these different classes of animals run altogether, and thus naturally add to the riot, danger, and confusion of the exhibition. Some of the barberi brought up to the rope, though small, being mostly rather under than over fourteen hands, are clean-legged, well-formed, compact, and spirited creatures, giving evidence of good blood; but taking the Roman racers generally, we doubt, were they mounted, whether they would not be beaten in most of our pony races.

Though betting, which gives such a perilous interest to our race-course, is by no means common, and the prize contended for so little worth, nothing can exceed the eagerness of the excitable Italians on these occasions. During the heat, the spectators honour with deafening "bravos" the horse that runs well, and hiss and hoot with almost equal noise all such as lag behind.

The Maltese have another very curious method of horse-racing. The horses are indeed mounted, but they are not furnished with saddle, bridle, or any things of the sort; the riders sit on the bare back, and have no reins or any thing else in their hands except a small pointed instrument, not unlike a cobbler's awl, with which they prick on their steeds. These races are held on a grand festival in the month of June, at Citta Vecchia in the interior of the island. The horses are generally barbs, imported from the neighbouring coast of Africa,—small, good tempered, and certainly not swift. To these characteristics of the animals which facilitate such a mode of equitation, we must add the important circumstance, that where the run or the great effort is made, they go up hill.—*Penny Magazine.*

[1] "A variety of horses," says Sir John Malcolm, "are produced in Persia. The inhabitants of the districts which border on the Gulf, still preserve pure those races of animals, which their ancestors brought from the opposite shore of Arabia. In Fars and Irak, they have a mixed breed from the Arabian, which, though stronger, is still a small horse, compared with either the Toorkoman or Khorassan breed, which are most prized by the soldiers of Persia. Both these latter races have also a great proportion of Arabian blood. The price of horses in Persia varies extremely. The common horse is always to be purchased for from fifteen to forty pounds; fine horses, particularly of the Toorkoman or Khorassan breed, are, in general, very dear; a hundred pounds is a common price, and sometimes a much larger sum is paid. They are often valued more from their breed than their appearance."

[2] I have seen vicious horses in Egypt cured of the habit of biting, by presenting to them, while in the act of doing so, a leg of mutton just taken from the fire: the pain which a horse feels in biting through the hot meat, causes it, after a few lessons, to abandon the vicious habit.

The Bedouins never allow a horse, at the moment of his birth, to fall upon the ground: they receive it in their arms, and so cherish it for several hours, occupied in washing and stretching its tender limbs, and caressing it as they would a baby. After this they place it on the ground, and watch its feeble steps with particular attention, prognosticating from that time the excellencies or defects of their future companion.—*Burckhardt's Travels.*

Arabian horses never lie down night nor day; they usually sixteen hands high; and all of them shaped, as they express it, with the elegance of an antelope.

Next to the Barb, travellers generally rank the Spanish genette. These horses, like the former, are little, but extremely swift and beautiful. The head is something of the largest; the mane thick: the ears long, but well pointed: the eyes filled with fire; the shoulder thickish, and the breast full and large. The croup round and large; the legs beautiful, and without hair; the pastern a little of the longest, as in the Barb, and the hoof rather too high. Nevertheless, they move with great ease, and carry themselves extremely well. Their most usual colour is black, or a dark bay. They seldom or never have white legs, or white snip. The Spaniards, who have a groundless aversion to these marks, never breed from such as have them. They are all branded on the buttock with the owner's name; and those of the province of Andalusia pass for the best. These are said to possess courage, obedience, grace, and spirit, in a greater degree than even the Barb; and for this reason they have been preferred as war-horses to those of any other country.[1]

The Italian horses were once more beautiful than they are at present, for they have greatly neglected the breed. Nevertheless, there are still found some beautiful horses among them, particularly among the Neapolitans, who chiefly use them for the draught. In general, they have large heads and thick necks. They are also restive, and consequently unmanageable. These faults, however, are recompensed by the largeness of their size, by their spirit, and the beauty of their motion. They are excellent for show, and have a peculiar aptitude to prance.

The Danish horses are of such an excellent size, and so strong a make, that they are preferred to all others for the draught. There are some of them perfectly well shaped; but this is but seldom seen, for in general they are found to have a thick neck, heavy shoulders, long and hollow back, and a narrow croup: however, they all move well, and are found excellent both for parade and war. They are of all colours, and often of whimsical ones, some being streaked like the tiger, or mottled like the leopard.

The German horses are originally from Arabian and Barbary stocks: nevertheless, they appear to be small and ill-shaped: it is said also, that they are weak and washy, with tender hoofs.[2] The Hungarian horses, on the other hand, are excellent for the draught, as well as the saddle. The hussars, who use them in war, usually slit their nostrils; which is done, as it is said, to prevent their neighing, but, perhaps, without any real foundation.

The Dutch breed is good for the draught, and is generally used for that purpose over Europe: the best come from the province of Friezland. The Flanders' horses are much inferior to the former; they have most commonly large heads, flat feet, and swollen legs; which are an essential blemish in horses of this kind.

The French horses are of various kinds, but they have few that are good. The best horses of that country come from Limosin; they have a strong resemblance to the Barb, and, like them, they are excellent for the chase; but they are slow in coming to perfection; they are to be carefully treated while young, and must not be backed till they are eight years old. Normandy furnishes the next best; which, though not so good for the chase, are yet better for war. In general, the French horses have the fault of being heavy-shouldered, which is opposite to the fault of the Barb, which is too thin in the shoulder, and is consequently apt to be shoulder-slipt.[3]

---

are always kept standing, and even after a long journey are only suffered to give a tumble or two on the sand, and then made to rise. This custom prevails all over Egypt. A real Arab steed is worth from three to five hundred pounds. The mares only are prized, and these must neither bite nor kick, or they are deemed vicious; indeed, they are so free from vice, that it is common to see the Bedouin children playing under their bellies. When an Arab sells his mare, he rarely sells all his property in her; he disposes of what he calls a third or fourth, which is merely a reservation of the second or third foal for himself or his family. Their genealogy must be proved at Mecca, for one race only is valued, which is that of the Prophet's favourite mare. Mahomet, it is said, prized this animal for refusing to drink after a long journey in the desert, when he called his stud from the well, and this mare was the only one to leave the water. It is so difficult to get a thorough-bred Arab mare to send out of the country, that I doubt if any ever go to England.—*Madden's Travels.*

[1] Spain was early celebrated for a breed of fine horses. These took their rise in the Moorish horse, or Barb, at the time the greater part of the peninsula was under the subjection of the Moors. When the Roman empire was at its height, the horses of Calpe were in higher repute than any other European breed. Calpe, the modern Gibraltar, is situated at nearly the south-west extremity of Spain; consequently, nearly opposite to Abyla, on the Barbary coast, and from thence they received their horses; hence the origin of the genettes.

[2] The German horses are generally large, heavy, and slow. The Hungarian may be an exception, being lighter and speedier.

[3] France contains various breeds of horses; and although much attention has been paid to improving the different races, the experiment has not been attended with full success. The Emperor Napoleon was extremely anxious that his horses might cope with those of England, and used every means to procure some of our best blood ones, as well as Arabians. Of late years, many steeds of racing blood have been sold to the French, and some of the nobility have hired persons from Eng-

Having mentioned the horses most usually known in Europe, we pass on to those of more distant countries, of whose horses we can only judge by report. We mentioned the wild horses of America. Such as are tame, if we may credit the latest reports,[1] are admirable.[2] Great numbers of these are bred up to the chase, and are chiefly kept for this purpose, particularly at Quito. The hunters, as Ulloa informs us, are divided into two classes; one part on foot, the other on horseback: the business of the footmen is to rouse the deer; and that of the horsemen, to hunt it down. They all, at break of day, repair to the place appointed, which is generally on the summit of a hill, with every man his greyhound. The horsemen place themselves on the highest peaks; whilst those on foot range the precipices, making a hideous noise, in order to start the deer. Thus the company extend themselves three or four leagues, or more, according to their numbers.[3] On starting any game, the horse which first perceives it sets off, and the rider, being unable to guide or stop him, pursues the chase, sometimes down such a steep slope, that a man on foot, with the greatest care, could hardly keep his legs; from thence he flies up a dangerous ascent, or along the side of a mountain; so that a person not used to this exercise would think it much safer to throw himself out of the saddle, than commit his life to the precipitate ardour of his horse. The other horses which join in the chase do not wait for the riders to animate them; they set forward immediately upon seeing another at full speed; and it becomes prudence in the rider to give them their way, and at the same time to let them feel the spur, to carry him over the precipices. These horses are backed and exercised to this method of hunting; and their usual pace is trotting.

There are said to be very good horses in the islands of the Archipelago. Those of Crete were in great reputation among the ancients for their swiftness and force; however, at present they are but little used, even in the country itself, because of the unevenness of the ground, which is there very rocky and mountainous. The original horses of Morocco are much smaller than the Arabian breed; however, they are very swift and vigorous. In Turkey there are to be found horses of almost all races: Arabian, Tartars, Hungarians, and those natural to the place. The latter are very beautiful and elegant; they have a great deal of fire, swiftness, and management; but they are not able to support fatigue: they eat little; they are easily heated; and they have skins so sensible, that they can scarcely bear the rubbing of the stirrup. The Persian horses are, in general, the most beautiful and most valuable of all the East. The pastures in the plains of Media, Persepolis, Ardebil, and Derbent, are excellent for the purpose of rearing them; and there were bred in those places vast numbers, by order of the government of Persia, while that country was under any government. Pietro della Valle prefers the horses of Persia to those of Italy;

---

land acquainted with breeding; but all their efforts to produce horses equal to ours for beauty, fleetness, and strength, have proved abortive. There are various excellent and serviceable breeds in different provinces; those of Normandy have long been celebrated as carriage and troop horses. During the late war, this province was a great nursery for the cavalry. The Norman horses are tall and strong boned; with considerable spirit, and at the same time docile in their habits. After the Norman conquest, William being sensible of the superiority of this breed, imported many of them into England, and by crossing them with our native breeds, produced good troop horses and roadsters. The best hackneys in France are bred in Limousin; they are closely allied to the Spanish breed, and have in all probability sprung from them. They are also, from their spirit, well calculated for hunters, in which capacity they acquit themselves better than any others of the French stock.

[1] Ulloa's Voyage, vol. i. p. 464.

[2] The English horse, with a good deal of blood, prevails in Virginia and Kentucky, and is found, in a greater or lesser degree, in all the States.

[3] The tribes in South America, who had learned to use horses, were never in want of those animals. At one time, an extent of open pasture equal to the whole area of Great Britain, was full of wild cattle of all kinds, and horses herded together in thousands and ten thousands. Falkner, the English Jesuit, upon one of his missionary journeys, was surrounded by them during a fortnight; thick troops sometimes passed by him in full speed for two or three hours together, and it was with much difficulty that he and the Indians in his company preserved themselves from being run over and trampled to death. They are easily captured. A piece of ground is burnt; when the new grass springs up, they are attracted to it by the richness of the pasture, and the hunters are ready to drive them into a decoy. The wild horses will surround the tame ones, caress them, and lead them away, as if they were acting rationally, and delighted in bringing them to the liberty which they themselves enjoyed; and it is found that the tame horses, if they have associated a little while with their free fellow-creatures, rebel fiercely afterwards against the bit and the saddle. Great numbers perish miserably in their wild state, and it is said that the greater part of the colts never grow up. The fly attacks them as soon as they are foaled, so that thousands are devoured by maggots: the Jaguars take a large share, and many are trodden to death by the horses in their drove. Great numbers die during seasons of drought: they rush at such times into the lakes and marshes, where many plunge into the mud and are lost, and others are trampled down by those who from behind press on with the same painful and raging impulse. Azara, more than once, saw the carcasses of many thousands which had thus been destroyed: and their skeletons are found on the edge of empty lakes, and in the dry channels of the rivers. They are of so little value that very many are killed merely for their fat, which is used in preparing deer skin, and the people go no where on foot.—*Southey's History of Brazil.*

and informs us, that they are in general of a middle size; and although some are found even of the smallest stature, yet that does not impair their beauty or their strength; yet, in some places, they are found of a very good size, and as large as the English saddle-horses are generally found to be: they have all a thin head, a fine crest, a narrow breast, small ears well placed, the legs fine, the hoof hard, and the croup beautiful; they are docile, spirited, nimble, hardy, courageous, and capable of supporting very great fatigue; they run very swiftly, without being easily fatigued; they are strong, and easily nourished, being only supplied with barley and chopped straw; they are put to grass only for six weeks in the spring; they have always the tail at full length, and there is no such thing as geldings among the number; they are defended from the air, as in England, by body-clothes: they attend them with the most punctual exactness; and they are rid generally in a snaffle, without spurs. Great numbers of these are every year transported into Turkey, but chiefly into the East Indies: however, after all, travellers agree that they are not to be compared to the Arabian horses, either for courage, force, or beauty; and that the latter are eagerly sought, even in Persia.

The horses of India are of a very indifferent kind, being weak and washy.[1] Those which are used by the grandees of the country come from Persia and Arabia; they are fed with a small quantity of hay during the day; and at night they have boiled peas, mixed with sugar and butter, instead of oats or barley: this nourishment supports them, and gives them strength, otherwise they would soon sink and degenerate. Those naturally belonging to the country, are very small and vicious. Some are so very little, that Tavernor reports, that the young Mogul prince, at the age of seven or eight, rode one of those little horses, that was not much larger than a greyhound: and it is not long since one of these was brought over into this country as a present to our Queen, that measures no more than nine hands high: and is not much larger than a common mastiff. It would seem, that climates excessively hot are unfavourable to this animal. In this manner, the horses of the Gold-Coast, and of Guinea, are extremely little, but very manageable. It is a common exercise with the grandees of that country, who are excellent horsemen, to dart out their lances before them upon full gallop, and to catch them again before they come to the ground. They have a sport also on horseback that requires great dexterity in the rider, and a great share of activity in the horse: they strike off a ball, with a battledore, while they are upon a full gallop, and pursuing it, strike it again before it comes to the ground; and this they continue for a mile together, striking sometimes to the right, and sometimes to the left, with amazing speed and agility.

The horses of China are as indifferent as those of India: they are weak, little, ill-shaped, and cowardly. Those of Corea are not above three feet high; almost all the breed there are made geldings, and are so timorous, that they can be rendered no way serviceable in war; so that it may be said, that the Tartar horses were properly the conquerors of China. These, indeed, are very serviceable in war, and although but of a middle size, yet they are surprisingly patient, vigorous, swift, and bold; their hoofs are extremely hard, though rather too narrow; their heads are fine, but rather too little; the neck is long and stiff; the legs of the longest; and yet, with all these faults, they are found to be an excellent breed. The Tartars live with their horses pretty much in the same manner as the Arabians do; they begin to back them at the age of seven or eight months, placing their children upon them, who manage them even at that early age. By these means they break them by little and little, till at last, about the age of six or seven years, they are capable of enduring amazing hardships. Thus they have been known to march two or three days without once stopping; to continue five or six, without eating any thing except a handful of grass at every eight hours; and, besides, to remain without drinking for four and twenty hours. These horses, which are so vigorous in their own country, lose all their strength when they are brought into China or the Indies; but they thrive pretty well in Persia and Turkey. The race of little Tartars towards the north have also a breed of little horses, which they set such a value upon, that it is forbidden to sell them to strangers: these horses have the very same qualities with those of the larger kind; which they probably derive from a similar treatment. There are also very fine horses in Circassia and Mingrelia. There are some greatly esteemed in the Ukraine, in Walachia, Poland, and Sweden; but we have no particular accounts of their excellencies or defects.

If we consult the ancients on the nature and qualities of the horses of different countries, we learn that the Grecian horses, and particularly those of Thessaly, had the reputation of being excellent for war; that those of Achaia were the largest that were known; that the most beautiful came from Egypt, which bred great numbers; that the horses of Ethiopia were not in esteem, from the heat of the country; that Arabia and Africa furnished very beautiful horses, and very fit for the course; that those of Italy, and particularly of Apulia, were very good; that in Sicily, Cappadocia, Syria, Armenia, Media, and Persia, there were excellent horses, equally esteemed for their speed and vigour; that those of Sardinia and Corsica, though small, were spirited and courageous; that those of Spain resembled the Parthian horses, in being very well adapted for war; that in Walachia and Transylvania, there were horses with bushy tails, and manes hanging down to the ground, which, nevertheless, were extremely swift and active; that the Danish horses were good leapers; those of Scandinavia, though little, were well shaped, and possessed of great agility; that the Flanders' breed was strong; that the Gaulish horses were good for carrying burdens; that German breeds were so bad, so diminutive, and ill-shaped, that no use could be made of them; that the Swiss and Hungarian horses were good; and, lastly, that those of India were very diminutive and feeble.

---

[1] The climate of India does not seem favourable to the horse. The breeds which may be termed native, or such as have been in use from time immemorial, are weak and degenerate. It is found necessary, in order to keep up a good stock, to have horses introduced from foreign countries. The breed called the *Tazee* is, perhaps, of the older kind; they are of a slight make, with long hollow backs, their limbs placed ill below them, and are weak, spiritless animals, while they are extremely irritable and stubborn. The only redeeming quality is the easiness of their paces, which, in a country where the heat is oppressive, is matter of no small consideration.

Such are the different accounts we have of the various races of horses in different parts of the world. I have hitherto omitted making mention of one particular breed more excellent than any that either the ancients or moderns have produced; and that is our own. It is not without great assiduity and unceasing application, that the English horses are now become superior to those of any other part of the world, for size, strength, swiftness, and beauty. It was not without great attention, and repeated trials of all the best horses in different parts of the world, that we have been thus successful in improving the breed of this animal; so that the English horses are now capable of performing what no others ever could attain to. By a judicious mixture of the several kinds, by the happy difference of our soils, and by our superior skill in management, we have brought this animal to its highest perfection. An English horse, therefore, is now known to excel the Arabian in size and swiftness, to be more durable than the Barb, and more hardy than the Persian. An ordinary racer is known to go at the rate of a mile in two minutes: and we had one instance, in the admirable Childers, of still greater rapidity. He has been frequently known to move above eighty-two feet and a half in a second, or almost a mile in a minute; he has also run round the course of Newmarket, which is very little less than four miles, in six minutes and forty seconds. But what is surprising, few horses have been since found that ever could equal him; and those of his breed have been remarkably deficient.[1]

However this be, no horses can any way equal our own, either in point of swiftness or strength; and these are the qualifications our horsemen seem chiefly to value. For this reason, when the French, or other foreigners, describe our breed, they all mention, as a fault, the awkward and ungainly motion of our horses; they allow them to be very good, indeed, but they will not grant them an easy or an elegant carriage. But these writers do not consider that this seeming want of grace is entirely the result of our manner of breaking them. We consult only speed and despatch in this animal's motions: the French and other nations are more anxious for parade and spirit. For this reason, we always throw our horses forward, while they put them upon their haunches: we give them an easy swift gait of going, that covers a great deal of ground; they, on the contrary, throw them back, giving them a more showy appearance indeed, but one infinitely less useful. The fault of our manner of breaking is, that the horse is sometimes apt to fall forward: the French managed-horse never falls before, but more usually on one side: and for this reason the rider wears stiff boots to guard his legs against such accidents. However, it would be a very easy matter to give our horses all that grace which foreigners are so fond of; but it would certainly take from their swiftness and durability.

---

[1] This horse was well known by the name of the Flying, or Devonshire, Childers. He was the property of the Duke of Devonshire, and allowed by sportsmen to be the fleetest horse that ever was bred in the world. He started repeatedly at Newmarket against the best horses of his time, and was never beaten. He won in different prizes, to the amount of nearly £20,000, and was afterwards reserved for breeding. The sire of Childers was an Arabian, sent by a gentleman as a present to his brother in England. Childers was somewhat more than fifteen hands in height. He was foaled in 1715, and was the property of Leonard Childers, Esq. of Carr House, near Doncaster, and sold when young to the Duke of Devonshire. It is said that Childers was first used as a hunter, where he evinced high qualities, and was noted for being very headstrong, as well as vicious. He had not however any restiveness. It is supposed his racing career commenced at five or six, and he beat all competitors at whatever distance. He was never tried at running a single mile, but his speed must have been almost a mile in a minute. He ran over the Beacon course, which is four miles, one furlong, and one hundred and thirty-eight yards, in seven minutes and thirty seconds; covering at every bound a space of about twenty-five yards. On one occasion, he made a spring or leap, with his rider on his back, on level ground, of twenty-five feet. Childers died in the Duke of Devonshire's stud in 1741, aged twenty-six years. There were various other coursers of the same name nearly cotemporary with this prince of horses. Bleeding Childers, so named from his having frequent bleedings at the nose, afterwards called Young Childers, and finally Bartlett's Childers: he was full brother to Flying Childers, and was never trained.

[2] See Buffon's account of our horses.

But in what degree of contempt soever, foreigners might formerly have held our horses, they have for some time perceived their error, and our English hunters are considered as the noblest and the most useful horses in the world. Our geldings are, therefore, sent over to the continent in great numbers, and sell at very great prices; as for our mares and stallions, there is a law prohibiting their exportation; and one similar to this is said to have obtained even as early as the times of Athelstan, who prohibited their exportation, except where designed as presents.

Roger de Belegme, created Earl of Shrewsbury by William the Conqueror,[1] is the first who is recorded to have made attempts towards the mending our native breed. He introduced Spanish stallions into his estate at Powisland in Wales, from which that part of the country was for many ages after famous for a swift and generous race of horses; however, at that time strength and swiftness were more regarded than beauty; the horses' shapes, in time of action, being entirely hid by a coat of armour which the knights then usually put upon them either by way of ornament or defence.

The number of our horses in London alone, in the time of king Stephen, is said to have amounted to twenty thousand. However, long after, in the times of queen Elizabeth, the whole kingdom could not supply two thousand horses to form our cavalry. At present, the former numbers seem revived, so that in the late war, we furnished out above thirteen thousand horsemen; and could, if hard pushed, supply above four times that number. How far this great increase of horses among us may be beneficial or otherwise, is not the proper business of the present page to discuss; but certain it is, that where horses increase in too great a degree, men must diminish proportionably; as that food which goes to supply the one, might very easily be converted into nourishment to serve the other. But, perhaps, it may be speculating too remotely, to argue for the diminution of their numbers upon this principle, since every manufacture we export into other countries, takes up room, and may have occupied that place, which in a state of greater simplicity, might have given birth and subsistence to mankind, and have added to population.[1]

Be this as it will, as we have been at such expence and trouble to procure an excellent

---

[1] British Zoology, vol. i. p. 4. To this work I am indebted for several particulars with regard to the native animals of this island.—*Note by Goldsmith*

[1] The breed of horses in Great Britain is now as mixed as that of its inhabitants; the frequent introduction of foreign horses has given us a variety that no other single country can boast; most other countries producing only one kind, while ours, by a judicious mixture of the several species, by the happy difference of our soils, and by our superior skill and management, has brought each quality of this noble animal to the highest perfection. In the annals of Newmarket may be found instances of horses that have literally outstripped the wind, as the celebrated M. Condamine has shown in his remarks on those of Great Britain. The species used in hunting is a happy combination of the former with others superior in strength, but inferior in point of speed and lineage: a union of both is necessary; for the fatigues of the chase must be supported by the spirit of the one, as well as by the vigour of the other. No country can bring a parallel to the strength and size of our horses destined for the draught, or to the activity and strength united of those that form our cavalry. In London, there are instances of single horses that are able to draw on a plain, for a small space, the weight of *three tons!* But the most remarkable proof of the strength of our British horses is to be drawn from that of our mill-horses; some of these will carry, at one load, thirteen measures, which at a moderate computation of seventy pounds each, will amount to 916 pounds. Our cavalry in the late campaigns (when they had an opportunity) showed, over those of our allies, as well as the French, a great superiority both of strength and activity; the enemy was broken through by the impetuous charge of our squadrons; when the German horses, from their great weight and inactive make, were unable to second our efforts.

We proceed to notice a little more particularly some of the more prominent kinds of British horses. In doing so, we shall chiefly follow the "Treatise on the Horse," published in the Library of Useful Knowledge.

THE COACH-HORSE. This animal has fully shared in the progress of improvement, and is as different from what he was fifty years ago as it is possible to conceive. The clumsy-barrelled, cloddy-shouldered, round-legged, black family horse, neither a coach nor a dray-horse, but something between both, as fat as an ox, and, with all his pride and prancing at first starting, not equal to more than six miles an hour, and knocking-up with one hard day's work, is no more seen; and we have, instead of him, an animal as tall, deep-chested, rising in the withers, slanting in the shoulders, flat in the legs, with even more strength, and with treble the speed. There is a great deal of deception, however, even in the best of these improved coach-horses. They prance it nobly through the streets; and they have more work in them than the old clumsy, sluggish breed: but they have not the endurance that could be wished,—and a pair of poor post-horses would, at the end of the second day, beat them hollow. The knee-action, and high lifting of the feet in the carriage-horse is deemed an excellence, because it adds to the grandeur of his appearance; but it is necessarily accompanied by much wear and tear of the legs and feet. The principal points in the coach-horse are, substance well placed, a deep and well proportioned body, bone under the knee, and sound, open, tough feet.

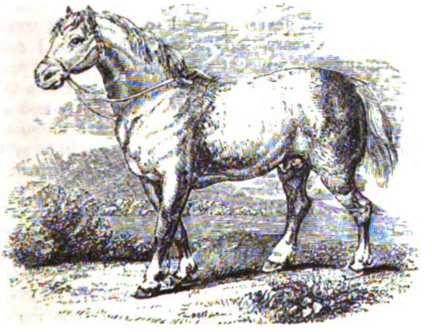
The origin of the better kind of coach-horse is the Cleveland Bay, confined principally to Yorkshire and Durham, with, perhaps, Lincolnshire on one side, and Northumberland on the other, but difficult to meet with pure in either county. The Cleveland mare is crossed by a three-fourth, or thoroughbred horse of sufficient breed of horses, it is not now to be expected that we should decline the advantages arising from it, just when in our possession. It may be therefore the most prudent measure in our legislature, to encourage the breed as a useful branch of commerce, and a natural defence to the country. But how far this end is answered by the breeding up of racers, is what most

---

substance and height, and the produce is the coach-horse most in repute, with his arched crest and high action. From the thoroughbred of sufficient height, but not of so much substance, we obtain the four-in-hand, and superior curricle-horse. From less height and more substance we have the hunter and better sort of hackney; and, from the half bred, we derive the machineer, the poster, and the common carriage-horse: indeed, Cleveland, and the Vale of Pickering, in the East Riding of Yorkshire, may be considered as the most decided breeding county in England for coach-horses, hunters, and hackneys. The coach-horse is nothing more than a tall, strong, oversized hunter. The hackney has many of the qualities of the hunter on a small scale.

Heavy Draught Horses. The Cleveland horses have been known to *carry* more than seven hundred pounds sixty miles in twenty-four hours, and to perform this journey four times in a week; and mill-horses have carried nine hundred and ten pounds two or three miles. Horses for slower draught, and sometimes even for the carriage, are produced from the **Suffolk Punch**, so called from his round punchy make, and descended from the Norman stallion and the Suffolk cart mare. The true Suffolk, like the Cleveland, is now nearly extinct. It stood from fifteen to sixteen hands high, of a sorrel colour; was large headed; low shouldered, and thick on the top; deep and round chested; long backed; high in the croup; large and strong in the quarters; full in the flanks, round in the legs; and short in the pasterns. It was the very horse to throw his whole weight into the collar, with sufficient activity to do it effectually, and hardihood to stand a long day's work. The present breed possesses many of the peculiarities and good qualities of its ancestors. It is more or less inclined to a sorrel colour; it is a taller horse; higher and finer in the shoulders; and is a cross with the Yorkshire half or three-fourths bred.

The **Clydesdale** is an excellent draught-horse, and particularly for farming business and in a hilly country. It derives its name from the district on the Clyde in Scotland, where it is principally bred. The Clydesdale horse owes its origin to one of the dukes of Hamilton, who crossed some of the best Lanark mares with stallions which he had brought over from Flanders. The Clydesdale is larger than the Suffolk, and has a better head, a longer neck, a lighter carcase, and deeper legs; strong, hardy, pulling true, and rarely restive. The southern parts of Scotland are principally supplied from this district; and many Clydesdales, not only for agricultural purposes, but for the coach and the saddle, find their way to the central, and even southern counties of England. Dealers from almost every part of the United Kingdom attend the markets of Glasgow and Rutherglen.

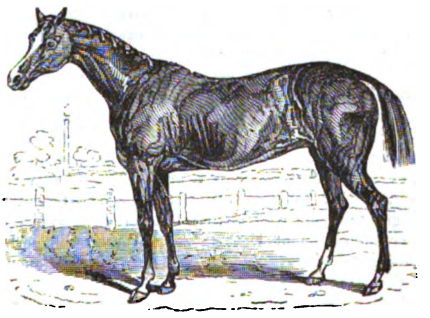


The Heavy Black Horse is the last variety it may be necessary to notice. It is bred chiefly in the midland counties from Lincolnshire to Staffordshire. Many are bought up by the Surrey and Berkshire farmers at two years old,—and being worked moderately until they are four, earning their keep all the while, they are then sent to the London market, and sold at a profit of ten or twelve per cent.

These heavy horses are bred in the highest perfection, *as to size*, in the fens of Lincolnshire, and few of them are less than seventeen hands high at two and a half years old. The largest of this heavy breed of black horses are used as *dray-horses*. The next in size are sold as *waggon-horses;* and a smaller variety, and with more blood, constitutes a considerable part of our *cavalry*, and is likewise devoted to undertaker's work. All our heavy draught horses, and some even of the lighter kind, have been lately much crossed by the Flanders breed, and with evident improvement.

The Cavalry Horses contain a different proportion of blood, according to the nature of the service required, or the caprice of the commanding officer. Those of the household troops are from half to three-fourths bred. Some of the lighter regiments have more blood in them. Our cavalry horses were formerly large and heavy. To his imposing size was added action as imposing. The horse was trained to a peculiar, and grand and beautiful method of going; but he was often found deficient in real service, for this very action diminished his speed, and added to his labour and fatigue. A considerable change has taken place in the character of our war-horses: lightness and activity have succeeded to bulk and strength; and for skirmishing and sudden attack the change is an improvement. It is particularly found to be so in long and rapid marches, which the lighter troops scarcely regard, while the heavier horses, with their more than comparative additional weight to carry, are knocked up. There was, however, some danger of carrying this too far; for it was found that in the engagements previous to, and at the battle of Waterloo, our heavy household troops alone were able to repulse the formidable charge of the French guard.

The Race Horse. There is much dispute with regard to the origin of the *thorough-bred horse*. By some he is traced through both sire and dam to Eastern parentage; others believe him to be the native horse, improved and perfected by judicious crossing with the Barb, the Turk, or the Arabian. "The Stud Book," which is an authority acknowledged by every English breeder, traces all the old racers to some Eastern origin; or it traces them until the pedigree is lost in the



persons, versed in this subject, are very apt to question. They assert, that the running-horse, as the breed has been for a long time refined, is unfit for any other service than that of the course, being too slight either for the road, the chase, or the combat; and his joints so delicately united, as to render him subject to the smallest accidents. They, therefore,

---

uncertainty of an early period of breeding. If the pedigree of a racer of the present day be required, it is traced back to a certain extent, and ends with a well-known racer;—or if an earlier derivation be required, that ends either with an Eastern horse, or in obscurity.

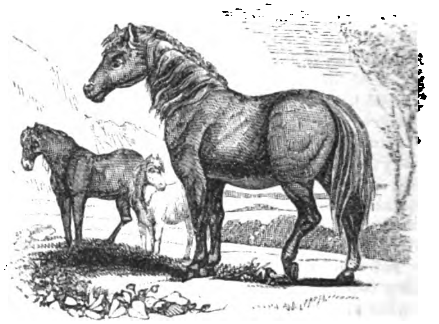
It must, on the whole, be allowed, that the present English thorough-bred horse is of foreign extraction, improved and perfected by the influence of the climate, and by diligent cultivation. There are some exceptions, as in the case of Sampson and Bay-Malton, in each of whom, although the best horses of their day, there was a cross of vulgar blood; but they are only exceptions to a general rule. In our best racing stables, and, particularly in the studs of the Earls of Grosvenor and Egremont, this is an acknowledged principle; and it is not, when properly considered, a principle at all derogatory to the credit of the country. The British climate, and British skill, made the thorough-bred horse what he is.

The beautiful tales of Eastern countries, and somewhat remoter days, may lead us to imagine that the Arabian horse possesses marvellous powers; but it cannot admit of a doubt, that the English trained horse is more beautiful, and far swifter and stouter than the justly-famed coursers of the desert. In the burning plains of the East, and the frozen climate of Russia, he has invariably beaten every antagonist on his native ground. A few years ago, RECRUIT, an English horse of moderate reputation, easily beat PYRAMUS, the best Arabian on the Bengal side of India.

The racer is generally distinguished by his beautiful Arabian head;—his fine and finely-set-on neck;—his oblique, lengthened shoulders;—well-bent hinder legs;—his ample, muscular quarters—his flat legs, rather short from the knee downward, although not always so deep as they should be;—and his long and elastic pastern.

THE HUNTER, or the hunting horse, is in value and beauty next to the racer. He should seldom be under fifteen or more than sixteen hands high; below this standard he cannot always sufficiently measure the object before him, and above this, he is apt to be leggy and awkward at his work. In proportion as the agriculture of the country is improved, the speed of the chase is increased. The scent both of the fox and the hare will lie better in inclosed and well-cultivated ground, than on open, barren heaths; and there is more running *breast-high* than when the hound is compelled to pick out the scent, carrying his nose almost close to the ground, and consequently going more slowly. The character of the hunter is consequently gradually changing. Stoutness is still required, but speed is becoming more necessary, and, therefore, for the fox, and the deer, and even for the hare, blood is an essential quality. In strong, thickly inclosed countries, the half-bred horse may get tolerably well along; but for general use the hunter should be at least three-quarters bred, perhaps seven-eighths. If he could be obtained with bone enough, and different action, a *thorough-bred horse* would form the best of all hunters: but the thorough-bred horse, with the usual action of the racer, would not, even at three-quarters speed, always carry himself sufficiently high to be aware of and to clear his fences.

A horse between thirteen and fourteen hands in height is called a GALLOWAY, from a beautiful breed of little horses once found in the south of Scotland, on the shore of the Solway Firth, but now sadly degenerated, and almost lost, from the attempts of the farmers to obtain a larger kind, and better adapted for the purposes of agriculture. There is a tradition in that country that the breed is of Spanish extraction, some horses having escaped from one of the vessels of the Grand Armada, which was wrecked on the neighbouring coast. This district, however, so early as the time of Edward I. supplied that monarch with a great number of horses. The pure galloway was said to be nearly fourteen hands high, and sometimes more; of a bright bay, or brown, with black legs, small head and neck, and peculiarly deep and clean legs. Its qualities were speed, stoutness, and sure-footedness over a very rugged and mountainous country. Dr Anderson thus describes the galloway: "There was once a breed of small elegant horses in Scotland, similar to those of Iceland and Sweden, and which were known by the name of galloways; the best of which sometimes reached the height of fourteen hands and a half. One of this description I possessed, it having been bought for my use when a boy. In point of elegance of shape it was a perfect picture; and in disposition was gentle and compliant. It moved almost with a wish, and never tired. I rode this little creature for twenty-five years, and, twice in that time I rode a hundred and fifty miles at a stretch, without stopping, except to bait, and that not for above an hour at a time. It came in at the last stage with as much ease and alacrity as it travelled the first. I could have undertaken to have performed on this beast, when it was in its prime, sixty miles a-day for a twelvemonth running without any extraordinary exertion."



A galloway in point of size, whether of Scotch origin or not we are uncertain, performed, about the year 1814, a greater feat than Dr Anderson's favourite. It started from London with the Exeter mail, and, notwithstanding the numerous changes of horses, and the rapid driving of that vehicle, it arrived at Exeter (one hundred and seventy-two miles) a quarter of an hour before the mail. We saw him about a twelvemonth afterwards, wind-galled, spavined, ring-boned, and a lamentable picture of the ingratitude of some human brutes towards a willing and faithful servant. In 1754, Mr Corker's galloway went one hundred miles a-day for three successive days, over the Newmarket course, and without the slightest distress. A galloway belonging to Mr Sinclair, of Kirby-Lonsdale, performed at Carlisle the extraordinary feat of one thousand miles in a thousand hours.

The *Welsh pony* is one of the most beautiful little animals that can be imagined. He has a small head, high withers, deep yet round barrel, short joints, flat conclude that less encouragement given to racing would be a means of turning us from breeding rather for swiftness than strength; and that we should thus be again famous for our strong hunters, which they say are wearing out from among us.

How far this may be fact, I will not take upon me to determine, being but little versed in a subject that does not properly come within the compass of natural history. Instead therefore of farther expatiating on this well known animal's qualifications,[1] upon which

---

legs, and good round feet. He will live on any fare, and can never be tired out.

The *Exmoor Ponies*, although generally ugly enough, are hardy and useful.

There is on Dartmoor a race of ponies much in request in that vicinity, being sure-footed, and hardy, and admirably calculated to scramble over the rough roads and dreary wilds of that mountainous district. The Dartmoor pony is larger than the Exmoor, and, if possible, uglier. He exists there almost in a state of nature.

The *Highland Pony* is far inferior to the galloway. The head is large, he is low before, long in the back, short in the legs, upright in the pasterns, rather slow in his paces, and not pleasant to ride, except in the canter. His habits make him hardy, for he is rarely housed in the summer or the winter. The Rev Mr Hall, in his "Travels in Scotland," says, that "when these animals come to any boggy piece of ground, they first put their nose to it, and then pat on it in a peculiar way with one of their forefeet, and from the sound and feel of the ground, they know whether it will bear them. They do the same with ice, and determine in a minute whether they will proceed."

The *Shetland Pony*, called in Scotland *Sheltie*, an inhabitant of the extremest northern Scottish isles, is a very diminutive animal, sometimes not seven hands and a half in height, and rarely exceeding nine and a half. He is often exceedingly beautiful, with a small head, good-tempered countenance, a short neck, fine towards the throttle, shoulders low and thick, (in so little a creature far from being a blemish,) back short, quarters expanded and powerful, legs flat and fine, and pretty round feet. They possess immense strength for their size, will fatten upon anything; and are perfectly docile. One of them nine hands, or three feet in height, carried a man of twelve stone, forty miles in one day.

THE IRISH HORSE. In some of the rich grazing counties, as Meath and Roscommon, a large long bloodhorse is reared of considerable value, but he seldom has the elegance of the English horse; he is larger headed, more leggy, ragged-hipped, angular, yet with great power in the quarters, much depth beneath the knee, stout and hardy, full of fire and courage, and the best leaper in the world.

The Irish horse is generally smaller than the English. He is stinted in his growth, for the poverty and custom of the country have imposed upon him much hard work, at a time when he is unfit for labour of any kind. For this reason, too, the Irish horse is deficient in speed. There is, however, another explanation of this. The Irish thorough-bred horse is not equal to the English. He is comparatively a weedy, leggy, worthless animal, and very little of him enters into the composition of the hunter or the hackney.

For *leaping* the Irish horse is unrivalled. It is not, however, the leaping of the English horse, striding as it were over a low fence, and stretched at his full length over a higher one; it is the proper *jump* of the deer, beautiful to look at, difficult to sit, and, both in height and extent, unequalled by the English horse.

If we look to the commerce of Ireland, there are few stage waggons, or drays with immense cattle belonging to them, but almost every thing is done by one-horse carts. In the North of Ireland, some stout horses are employed in the carriage of linen, but the majority of the *garrons* used in agriculture or commercial pursuits are miserable and half-starved animals. In the north it is somewhat better. There is a native breed in Ulster, hardy, and sure-footed, but with little pretension to beauty or speed.

[1] In buying a horse, one of the chief requisites to be attended to, is the degree of nervous energy which the animal possesses; and it is the union of this energy with good conformation that makes many horses invaluable. Its absence, or presence, however, is not likely to be discovered by the purchaser without a trial; and to avoid disappointment in this respect, it is therefore advisable to obtain one prior to purchase. The horse should be set to the work he will be called on to perform; and if he is intended for the saddle or single harness, he should have no companion on his trial, for many horses work well in company, that are downright sluggards when alone.

Some horses have an unpleasant way of going, or are difficult to manage, or have some vice which is only displayed at work. These are so many more reasons for having a trial prior to striking a bargain. But if that cannot be obtained, some sort of conclusion regarding the animal's spirit may be drawn from his general appearance. The way he carries his head, his attention to surrounding objects, his gait, and the lively motion of his ears, may all or each be looked to as indicative of "bottom" or willingness to work. It is only, however, in a private stable, or in that of a respectable dealer, that these *criteria* can be depended upon; for in a market-place, the animal is too much excited by the cracking of whips, and the too frequent application of them, to be judged of as regards his temper. Neither must the buyer be thrown off his guard by the animation which horses display at an auction, or on coming out of the stable of a petty dealer, for it is a fact which cannot be too well made known, that there are many unprincipled dealers, who make it their business, before showing a horse, to "put some life in him," that is, they torture him with the lash, till, between pain and fear, the poor animal is so much excited as to bound from side to side with his utmost agility, at the least sound or movement of the bystanders.

The head, as being a part not at all contributing to progression, should, in the saddle-horse, be small, that it may be light—the nostrils expanded to admit plenty of air, and the space between the branches of the lower jaw, called the channel, should be wide, that there may be plenty of room for the head of the windpipe. In the many volumes might easily be written, I will content myself with just mentioning the description of Camerarius, in which he professes to unite all the perfections which a horse ought to be possessed of:—"It must," says he, "have three parts like those of a woman; the breast must be broad, the hips round, and the mane long: it must in three things resemble a lion; its countenance must be fierce, its courage must be great, and its fury irresistible; it must have three things belonging to the sheep; the nose, gentleness, and patience: it must have three of a deer; head, leg, and skin: it must have three of a wolf; throat, neck, and hearing: it must have three of a fox: ear, tail, and trot: three of a serpent; memory, sight, and flexibility: and, lastly, three of a hare; running, walking and perseverance."[1]

CHAP. II.

OF THE ASS.[2]

Although this animal is very easily distinguished from the horse at first sight, yet upon a closer inspection, the similitude between them is very striking.[3] They have both a similar outline in the external parts; the same conformation within. One would be led, from the great resemblance there is between them, to suppose them of the same species;

---

draught-horse, a heavy head is not, as far as utility is concerned, an objection, for it enables him to throw some weight into the collar; and hence, excepting its ugliness, it is rather an advantage if he is used entirely for draught. But it makes the saddle-horse bear heavy on the hand of the rider, makes him liable to stumble, and, when placed at the end of a long neck, is apt to wear out the fore feet and legs by its great weight. The neck of the saddle-horse should be thin, not too much arched, and rather short than long, for the same reason that the head should be light: and, in the draught-horse, it may be thick, stallion-like, and sufficiently long to afford plenty of room for the collar, and for the same reason that the head may be large in this animal. The windpipe should be large, and standing well out from the neck, that the air may have an easy passage to and from the lungs. The horse used for both carrying and drawing should have a head and neck neither too light nor too heavy.

That the saddle-horse may be safe, and have extensive action, it is necessary that the withers be high. This advantage is indicated by the horse standing well up before; and it is usual, in showing a horse, to exaggerate the height of the forehand, by making him stand with his forefeet on a somewhat elevated spot. A horse with low withers appears thick and cloddy about the shoulder. In the ass and mule, the withers are very low, and the shoulders very flat, and this is the reason why they are so unpleasant to ride, and why it is next to impossible to keep the saddle in its proper place without the aid of a crupper. High withers, however, are not essential to the racer, or the draught-horse. The former does all his work by leaps, and that is performed best when the horse stands somewhat higher behind than before: neither are high withers necessary to the draught-horse: but in the roadster they are as important as the safety of the rider is, for a horse with a low forehand is easily thrown on his knees. In the draught-horse, this tendency towards the ground is obviated by the support the collar affords.

The chest should be deep and wide in all horses, but especially so in one intended for quick work, in order that there may be plenty of room for those important organs, the lungs.

The back should not be too long nor too short; for though length is favourable to an extended stride and rapid motion, yet it makes the horse weak, and unable either to draw or carry any considerable weight. On the other hand, if the back be too short, the horse's action must be confined, and short-backed horses in general make an unpleasant noise when trotting, by striking the shoe of the hind foot against the shoe of the fore one: and though they are in general very hardy, and capable of enduring much fatigue, and of living on but little food, yet a back of middling length is better by far than one immoderately short or long. The back should be nearly straight.

In the saddle-horse, and where safety is desirable, the position of the fore leg is worthy of attention. It should be placed well forward, and descend perpendicularly to the ground, the toe being nearly in a line with the point of the shoulder. The pasterns should neither be turned in nor out. When they are turned inwards, the horse is in general very liable to cut the fetlock-joint, by striking the opposite foot against it. The draught-horse may be excused, though he leans a little over his fore legs, but the saddle-horse will be apt to tumble if he does so.

The foot should be as nearly round as possible, smooth, and displaying no signs of brittleness by pieces being broken and chipped off by the nails; the sole should be but moderately concave; when flat, it is objectionable, and particularly so in the heavy, high-actioned horse, for there is then a probability of its becoming convex.

With regard to the important point, "mark of mouth:" At the age of six years, the mark in the teeth is gone from the two central nippers: they being the oldest by a year, are soonest worn down. At seven, the mark is worn out of the four central teeth, and at eight the majority of horses lose all mark, and afterwards may be styled aged; though the purchaser need not reject a horse because his mouth is too old to express his age, provided his limbs appear clean and firm, for few horses become useless from natural decay.—*From a small work entitled "Advice to Purchasers of Horses, by J. Stewart, Glasgow."*

[1] It is a curious natural fact, that the horse has the singular property of breathing through the nostril only, and not through the mouth; for in the severest exercise, the mouth is never seen open, unless the lower jaw be brought down violently by the force of the bit. This may account for the great dilatation of the nostrils after hard running.—*Turton.*

[2] Many parts of this account are extracted from Daubenton and Buffon; which I mention here, to avoid troubling the reader with a multiplicity of quotations.—*Note by Goldsmith.*

[3] The head of the ass is large and thick; the ears very long, the mane short and erect, with a dark brown stripe from the shoulders to the insertion of the tail, which is thick, covered with short hairs, and stunted towards its end. A dark stripe extends from the top of the withers to the insertion of the thigh, on each shoulder: the whole animal is covered with thickset woolly-like hair. His general colour is ash-coloured brown; sometimes chestnut; very dark brown, approaching to black: and sometimes, though rarely, white.

and that the ass was only a horse degenerated: however, they are perfectly distinct, and there is an inseparable line drawn between them, for the mule they produce is barren. This seems to be the barrier between every species of animals; this keeps them asunder, and preserves the unities of their form. If the mule, or the monster, bred between two animals, whose form nearly approaches, is no longer fertile, we may then conclude, that these animals, however resembling, are of different kinds. Nature has providently stopped the fruitfulness of these ill-formed productions, in order to preserve the form of every animal uncontaminated: were it not for this, the races would quickly be mixed with each other: no one kind would preserve its original perfection; every creature would quickly degenerate: and the world would be stocked with imperfection and deformity.

The horse and the ass, therefore, though so nearly approaching in form, are of two distinct kinds, different in their natures; and were there but one of each kind, both races would then be extinguished. Their shapes and their habits may, indeed, be very nearly alike; but there is something in every animal, besides its conformation or way of life, that determines its specific nature. Thus there is much greater resemblance between the horse and the ass, than between the sheep and the goat; and yet the latter produce an animal that is by no means barren, but which quickly reproduces an offspring resembling the sheep; while the mule of the former is marked with certain sterility. The goat and the sheep may be therefore said to be of one kind, although so much unlike in figure; while the horse and the ass are perfectly distinct, though so closely resembling. It has, indeed, been said by Aristotle, that their male is sometimes prolific; this, however, has not been confirmed by any other testimony, although there has elapsed a period of near two thousand years to collect the evidence.

But what tends to put the subject out of dispute, is that the two animals are found in a state of nature entirely different. The onager, or wild ass, is seen in still greater abundance than the wild horse; and the peculiarities of its kind are more distinctly marked than in these of the tame one. Had it been a horse degenerated, the likeness would be stronger between them, the higher we went to the original stock from whence both have been supposed to be sprung. The wild animals of both kinds would, in such a case, resemble each other, much more than those of the tame kind, upon whom art has, for a succession of ages, been exercising all its force, and producing strange habits and new alterations. The contrary, however, obtains, and the wild ass is even more assinine, if I may so express it, than that bred in a state of domestic servitude; and has even a natural aversion to the horse, as the reader will shortly learn.

The wild ass has, by some writers, been confounded with the zebra, but very improperly, for they are of a very different species. The wild ass is not streaked like the zebra, nor is his shape so beautiful; his figure is pretty much the same as that of the common ass, except that he is of a brighter colour, and has a white list running from his head to his tail. This animal is found wild in many islands of the Archipelago, particularly in that of Cerigo.[1] There are many wild asses in

---

The ass is three or four years in coming to perfection, but will propagate when two years old, and will continue to do so till about twenty-five years of age; Ælian says till thirty; alluding, probably, to those in eastern climates. The female goes with young above eleven months, and rarely brings forth more than one at a time. This animal seldom lies down to rest, unless extremely fatigued; he sleeps standing, and requires much less repose than the horse.

[1] *Hunting the Wild Ass.*—The sun was just rising over the summits of the eastern mountains, when my greyhound, Cooley, suddenly darted off in pursuit of an animal, which my Persians said, from the glimpse they had of it, was an antelope. I instantly put spurs to my horse, and, followed by Sedak Beg, and my provider, followed the chase. After an unrelaxed gallop of full three miles, we came up with the dog, who was within a short stretch of the creature we pursued; and, to my surprise—and, at first, vexation—I saw it to be an ass; but, on a moment's reflection, judging from its fleetness it must be a wild one—a species little known in Europe, but which the Persians prize above all other animals as an object of chase—I determined to approach to it as near as the very swift Arab I was on would carry me. But the single instant of checking my horse to consider, had given our game such a head of us, that, notwithstanding all our speed, we could not recover our ground on him. He then darted off again with the swiftness of thought, capering, kicking, and sporting in his flight, as if he were not blown in the least, and the chase were his pastime. He appeared to me to be about ten or twelve hands high; the skin smooth, like a deer's, and of a reddish colour, the belly and hinder parts partaking of a silvery grey; his neck was finer than that of a common ass, being longer, and bending like a stag's; and his legs beautifully slender. The head and ears seemed large, in proportion to the gracefulness of these forms; and by them I first recognised that the object of my chase was of the ass tribe. The mane was short and black, as was also a tuft which terminated his tail. No line whatever ran along his back, or crossed his shoulders as is seen on the tame species with us. When my followers of the country came up, they regretted I had not shot the creature when he was so within my aim, telling me his flesh is one of the greatest delicacies in Persia; but it would not have been to eat him that I should have been glad to have had him in my possession. The prodigious swiftness and peculiar manner with which he fled across the plain, coincided exactly with the description that Xenophon gives of the same animals in Arabia—(vide Anabasis, lib. i.) But, above all, it reminded me of the striking portrait drawn by the author of the

the deserts of Libya and Numidia, that run with such amazing swiftness that scarcely even the coursers of the country can overtake them. When they see a man, they set up a horrid braying, and stop short all together, till he approaches near them; they then, as if by common consent, fly off with great speed; and it is upon such occasions that they generally fall into the traps which are previously prepared to catch them. The natives take them chiefly upon account of their flesh, which they esteem as delicious eating; and for their skins, of which that kind of leather is made which is called *shagreen*.[1]

Olearius relates, that the monarch of Persia invited him on a certain day to be present at an entertainment of a very peculiar nature, which was exhibited in a small building, near the palace, resembling a theatre. After a collation of fruits and sweetmeats, more than thirty of these wild asses were driven into the area, among which the monarch discharged several shot, and some arrows, and in which he was imitated by some of the rest of his attendants. The asses, finding themselves wounded, and no way of escaping, instantly began to attack each other, biting with great fierceness, and braying terribly. In this manner they continued their mutual animosity, while the arrows were poured in from above, until they were all killed: upon which they were ordered to be taken, and sent to the king's kitchen at Ispahan. The Persians esteem the flesh of this animal so highly, that its delicacy is even become a proverb among them. What may be the taste of wild ass's flesh, we are unable to say; but certain it is, that the flesh of the tame ass is the worst that can be obtained, being drier, more tough, and more disagreeable than horse-flesh. Galen

---

Book of Job. I shall venture to repeat it, since the words will give life and action to the sketch:—"Who hath loosed the bonds of the wild ass? whose house I have made the wilderness, and the barren land his dwelling? He scorneth the multitude of the city, neither regardeth he the crying of the driver. The range of the mountain is his pasture."—*Sir R. K. Porter's Travels in Georgia.*

[1] Wild asses live in herds, each consisting of a chief, and several mares and colts, sometimes to the number of twenty. They are excessively timid, and provident against danger. A male takes upon him the care of the herd, and is always on the watch. If they observe a hunter who, by creeping along the ground, has got near them, the centinel takes a great circuit, and goes round and round him, as if discovering somewhat to be apprehended. As soon as the animal is satisfied, he rejoins the herd, which sets off with great precipitation. Sometimes his curiosity costs him his life; for he approaches so near as to give the hunter an opportunity of shooting him. The senses of hearing and smelling in these animals are most exquisite; so that they are not in general to be approached without the utmost difficulty. "The wild asses did stand in the high places," says the prophet Jeremiah; "they snuffed up the wind like dragons." The Persians catch them, and break them for the draught. They make pits, which they fill about half way up with plants; into these the asses fall without bruising themselves, and are taken thence alive. When completely domesticated, they are very valuable, and sell at a high price, being at all times celebrated for their amazing swiftness.

The food of the wild asses is the saltest plants of the desert; such as the artriplex, kali, and chenopondium; and also the bitter musky tribe of herbs. They also prefer salt water to fresh.—This is exactly conformable to the history given of this animal in the book of Job; for the words "barren land," expressive of his dwelling, ought, according to the learned Bochart, to be rendered *salt places* The hunters generally lie in wait for the asses near the ponds of brackish water, to which they resort to drink.

In the principal streets of Cairo, asses stand ready bridled and saddled for hire, and answer the same purpose as the hackney coaches in London. The person who lets them, accompanies his ass, running behind to goad him on, and to cry out to those on foot to make way. They are regularly rubbed down and washed, which renders their coat smooth and glossy. Their food is the same as that of the horse, usually consisting of chopped straw, barley, and beans. They here seem, says M. Denon, to enjoy the plenitude of their existence; they are healthy, active, cheerful, and the mildest and safest animals that a person can possibly have. Their natural pace is a canter or gallop: and without fatiguing his rider, the ass will carry him rapidly over the large plains which lie between different parts of the straggling city.

Sudden and unexpected internal impressions produce violent effects upon the animal system. Strong emotions of mind may deprive a man of his intellects, and of his life: and there are many instances of persons having died in consequence of having received sudden intelligence either of a joyful or distressing nature. The animal resembles man in this respect: any thing unexpected throws them into astonishment, and as the circulation of the blood is thereby at first accelerated, and afterwards suddenly stopped, the animal falls dead to the ground.

Host relates, in his account of Fez and Morocco, that he once saw at Meknes a live ass given to lions to be devoured by them. As soon as the ass entered the den and saw the lions, he immediately fell down dead. One of the lions instantly seized upon him, and sucked out his blood; but life had previously been extinguished in him, for he did not move a limb.

An ass at Chartres used to go to the chateau of Quarville, to hear the music that was often performed there. The owner of the chateau was a lady, who had an excellent voice, and whenever she began to sing, the ass never failed to draw nearer the window, and listen very attentively. Once when a piece was performed, which no doubt pleased him better than any he had ever heard before, he left his ordinary post, walked without ceremony into the music-room, and, in order to add to the concert what he thought was alone wanting to render it perfect, began to bray with all his might.

In Egypt and Arabia, asses are frequently seen of great size and elegance; and in their attitudes and movements they exhibit a degree of gracefulness unknown even in those of Spain. Their step is light and sure, and their pace is brisk and easy. They are not only in common use for riding in Egypt, but the Mahometan merchants, the most opulent of the inhabitants, and even ladies of the highest rank, use them; and not long since, they were the only animals on which Christians of any rank or quality were permitted to appear in the Capital —*Supplement to the English edition of Cuvier's Animal Kingdom.*

also says that it is very unwholesome. Yet we should not judge hastily upon the different tastes of different people, in the preference they give to certain meats. The climate produces very great changes in the tenderness and the savour of several viands: that beef, for instance, which is so juicy and good in England, is extremely tough and dry when killed under the line; on the contrary, that pork, which is with us so unpalatable in summer, in the warmer latitudes, where it is always hotter than here, is the finest eating they have, and much preferable to any hog's flesh in Europe.

The ass, like the horse, was originally imported into America by the Spaniards, and afterwards by other nations. That country seems to have been peculiarly favourable to this race of animals; and where they have run wild, they have multiplied in such numbers, that in some places they are become a nuisance. In the kingdom of Quito, the owners of the grounds where they are bred, suffer all persons to take away as many as they can, on paying a small acknowledgment, in proportion to the number of days their sport lasts. They catch them in the following manner. A number of persons go on horseback, and are attended by Indians on foot: when arrived at the proper places, they form a circle, in order to drive them into some valley; where, at full speed, they throw the noose, and endeavour to halter them. Those creatures, finding themselves enclosed, make very furious efforts to escape; and, if only one forces his way through, they all follow with an irresistible impetuosity. However, when noosed, the hunters throw them down, and secure them with fetters, and thus leave them till the chase is over. Then, in order to bring them away with greater facility, they pair them with tame beasts of the same kind; but this is not easily performed, for they are so remarkably fierce that they often hurt the persons who undertake to manage them. They have all the swiftness of horses, and neither declivities nor precipices can retard their career. When attacked, they defend themselves with their heels and mouth with such activity, that without slackening their pace, they often maim their pursuers. But the most remarkable property in these creatures is, that, after carrying their first load, their celerity leaves them, their dangerous ferocity is lost, and they soon contract the stupid look and dulness peculiar to the assinine species. It is also observable, that these creatures will not permit a horse to live among them. They always feed together; and if a horse happens to stray into the place where they graze, they all fall upon him; and, without giving him the liberty of flying, they bite and kick him till they leave him for dead upon the spot.[1]

Such is this animal in its natural state, swift, fierce, and formidable: but, in the state of tameness, the ass presents a very different picture: the moment his native liberty is repressed, he seems entirely to give up all claims to freedom; and he assumes a patience and submission even humbler than his situation. He is, in a state of tameness, the most gentle and quiet of all animals. He suffers with constancy, and, perhaps, with courage, all the ill-treatment that cruelty and caprice are pleased to inflict.[2] He is temperate with regard to the quantity and the quality of his provision. He is contented with the most neglected weeds; and makes his humble repast upon what the horse and other animals leave behind.[3] If he gives the preference to any vegetable, it is to the plantain; for which he is

---

[1] Ulloa, vol. i. p. 316.

[2] The following anecdote of the sagacity of an ass, and the attachment displayed by the animal to his master, may help, in some degree, to redeem that ill-used race from a portion of the load of stupidity which is generally assigned to them, and which with so many other loads, they bear with such exemplary patience. Thomas Brown, residing near Hawick, travelled the country as a higgler, having an ass the partner of his trade. From suffering under a paralytic affection, he was in the habit of assisting himself on the road, by keeping hold of the crupper of the saddle, or more frequently the *tail* of the ass. During a severe winter, some years ago, whilst on one of his journeys, near Rule water, "the old man and his ass" were suddenly plunged into a wreath of snow. There they lay long, far from help and ready to perish. At length the poor ass, after a severe struggle, got out; but finding his unfortunate master absent, he eyed the wreath for some time with a wistful look, and at last forced his way through it to where his master still lay, when, placing his body in such a position as to afford a firm grasp of the tail, the honest higgler was thereby enabled to take his accustomed hold, and was actually dragged out by the faithful beast to a place of safety.

[3] Sterne, in his Sentimental Journey, touchingly illustrates the patience of the poor ass.

I was just receiving (he says) the last compliment of Monsieur le Blanc, for a pleasant voyage down the Rhone, when I was stopped at the gate. 'Twas by a poor ass, who had just turned in with a couple of large panniers upon his back, to collect eleemosynary turnip-tops and cabbage-leaves; and stood dubious, with his two fore-feet on the inside of the threshold, and with his two hinder feet towards the street, as not knowing very well whether he was to go in or no.

Now, 'tis an animal (be in what hurry I may) I cannot bear to strike; there is a patient endurance of sufferings, wrote so unaffectedly in his looks and carriage, which pleads so mightily for him, that it always disarms me; and to that degree, that I do not like to speak unkindly to him: on the contrary, meet him where I will, whether in town or country, in cart or under panniers, whether in liberty or bondage, I have ever something civil to say to him on my part; and as one word begets another (if he has as little to do as I,) I generally fall into conversation with him; and surely never is my imagination so busy as in framing his responses from the etchings of his countenance, and, where those carry me not deep enough, in flying from my own heart into his, and seeing what is natural for an ass to think, as well as often seen to neglect every other herb in the pasture: but he is chiefly delicate with respect to his water; he drinks only at the clearest brooks, and chiefly those to which he has been accustomed. He drinks as soberly as he eats; and never, like the horse, dips his nose into the stream. As he is seldom saddled, he frequently rolls himself upon the grass; and lies down, for this purpose, as often as he has an opportunity, without minding what becomes of his burden. He never rolls, like the horse, in the mud; he even fears to wet his feet; and turns out of his way to avoid the dirty parts of a road. When very young, the ass is sprightly, and even tolerably handsome; but he soon loses these qualifications, either by age or bad treatment, and he becomes slow, stupid, and headstrong. He seems to show no ardour, except for the female, having been often known to die after the covering. The she-ass is not less fond of her young than the male is of her; and we are assured that she will cross fire or water to protect or rejoin it. This animal is sometimes not less attached to his owner, by whom he is too often abused. He scents him at a distance, and distinguishes him from others in a crowd; he knows the ways he has passed and the places where he inhabits.

When overloaded the ass shows the injustice of his master, by hanging down his head and lowering his ears; when he is too hard pressed, he opens his mouth and draws back his lips, in a very disagreeable manner. If his eyes are covered he will not stir a step; and, if he is laid down in such a manner, that one is covered with the grass while the other is hidden with a stone, or whatever is next at hand, he will continue fixed in the same situation, and he will not so much as attempt to rise to free himself from those slight impediments. He walks, trots, and gallops, like a horse; but although he sets out very freely at first, yet he is soon tired; and then no beating will make him mend his pace. It is in vain that his unmerciful rider exerts his whip or his cudgel; the poor little animal bears it all with patience, and without a groan; and, conscious of his own imbecility, does not offer even to move.

Notwithstanding the stupid heaviness of his air, he may be educated with as much ease as any other animal; and several have been brought up to perform, and exhibit as a show. In general, however, the poor animal is entirely neglected. Man despises this humble useful creature, whose efforts are exerted to please him, and whose services are too cheaply purchased. The horse is the only favourite, and upon him alone all expence and labour are bestowed. He is fed, attended, and stabled, while the ass is abandoned to the cruelty of the lowest rustics, or even to the sport of children; and instead of gaining by the lessons he receives, is always a loser. He is conducted along by blows; he is insulted by unnecessary stripes; he is overloaded by the lazy; and, being generally the property of the poor, he shares with them in their distresses. Thus this faithful animal, which, were there no horses, would be the first of the quadruped kind in our esteem, is now considered as nothing; his properties and qualifications being found in a higher degree elsewhere, he is entirely disregarded; and, from being the second, he is degraded into one of the most useless of the domestic quadrupeds.[1]

For this reason, very little care has been taken to improve the breed; it is suffered to

---

a man, upon the occasion. In truth, it is the only creature of all the classes of beings below me, with whom I can do this: for parrots and jackdaws, I never exchange a word with them, nor with the apes, for pretty near the same reason; they act by rote, as the others speak by it, and equally make me silent: nay, my dog and my cat, though I value them both (and for my dog he would speak if he could,) yet, somehow or other, they neither of them possess the talents for conversation. I can make nothing of a discourse with them, but, with an ass, I can commune for ever.

"Come, Honesty!" said I, seeing it was impracticable to pass betwixt him and the gate, "art thou for coming in, or going out?"

The ass twisted his head round to look up the street.

"Well," replied I, "we'll wait a minute for thy driver." He turned his head thoughtfully about, and looked wistfully the opposite way,

"I understand thee perfectly," answered I; "if thou takest a wrong step in this affair, he will cudgel thee to death. Well, a minute is but a minute, and if it saves a fellow-creature a drubbing, it shall not be set down as ill spent."

He was eating the stem of an artichoke as this discourse went on, and, in the little peevish contentions of nature betwixt hunger and unsavouriness, had dropped it out of his mouth half a dozen times, and picked it up again.

"God help thee, Jack," said I, "thou hast a bitter breakfast on't, and many a bitter day's labour, and many a bitter blow, I fear, for its wages; 'tis all—all bitterness to thee, whatever life is to others. And now thy mouth, if one knew the truth of it, is as bitter, I daresay, as soot (for he had cast aside the stem,) and thou hast not a friend, perhaps, in all this world, that will give thee a macaroon."

In saying this, I pulled out a paper of them, which I had just purchased, and gave him one; and at this moment that I am telling it, my heart smites me, that there was more of pleasantry in the conceit of seeing how an ass would eat a macaroon, than of benevolence in giving him one, which presided in the act.

When the ass had eaten his macaroon, I pressed him to come in; the poor beast was heavy loaded; his legs seemed to tremble under him; he hung rather backwards, and as I pulled at his halter, it broke short in my hand; he looked up pensive in my face—"Don't thrash me with it; but if you will, you may." The driver at this moment coming in, let fall a thundering bastinado upon the poor wretch's crupper, which put an end to the interview. Such is a sample of the unhappy treatment of this much-injured animal.

[1] In early times, the ass was not, as is now the case

degenerate; and it is probable, that of all other animals this alone is rendered feebler and more diminutive, by being in a state of domestic servitude. The horse, the cow, and the sheep, are rendered larger by the assiduity of man; the ass is suffered to dwindle every generation, and particularly in England, where it is probably that, but for the medicinal qualities of its milk, the whole species would have ere now been extinguished. Nevertheless, we have good reasons to believe that, were the same care bestowed on the ass that is spent upon the horse, were the same industry used in crossing the breed and improving it, we should see the ass become, from his present mean state, a very portly and serviceable animal; we should find him rival the horse in some of his perfections, and exceed him in others. The ass, bulk for bulk, is stronger than the horse; is more sure-footed; and though more slow in his motions, he is much less apt to start out of the way.

The Spaniards, of all people in Europe, seem alone to be acquainted with the value of the ass. They take all proper precautions to improve the breed; and I have seen a jackass, from that country, above fifteen hands high. This animal, however, seems originally a native of Arabia. A warm climate is known to produce the largest and the best; their size and spirit decline in proportion as they advance into colder regions.

Though now so common in all parts of England, the ass was entirely lost among us during the reign of queen Elizabeth. Holingshead informs us that our land did yield no asses.[1] However, there are accounts of their being common in England before that time. In Sweden, they are at present a sort of rarity; nor does it appear by the last history of Norway, that they have yet reached that country. It is in the hotter climates alone that we are to look for the original of this serviceable creature. In Guinea, they are larger and more beautiful than even the horses of the same country. In Persia, they have two kinds; one of which is used for burdens, being slow and heavy; the other, which is kept for the saddle, being smooth, stately, and nimble. They are managed as horses, only that the rider sits nearer the crupper, and they are taught to amble like them. They generally cleave their nostrils to give them more room for breathing, and many of these are sold for forty or fifty pounds.

The ass is a much more hardy animal than the horse, and liable to fewer diseases. Of all animals covered with hair, he is the least subject to vermin, for he has no lice, probably owing to the dryness and the hardness of his skin. Like the horse, he is three or four years in coming to perfection; he lives till twenty or twenty-five; sleeps much less than the horse; and never lies down for that purpose, unless very much tired. The she-ass goes above eleven months with young, and never brings forth more than one at a time. The mule may be engendered either between a horse and a she-ass, or between a jackass and a mare.[2] The latter breed is every way preferable, being

---

with us, considered a despicable animal; for we find that he was rode by the rich and noble, in preference to the horse; as will appear from the following instances, from many that are recorded in the Sacred Writings:—When Abraham went to offer his son Isaac, he rode upon an ass; Joseph and his brethren rode on asses when they went down to Egypt to purchase corn; and we are told, that when Moses left Jethro, his father-in-law, he took his wife and his sons, and set them upon asses, and returned to Egypt. In the enumeration of Job's property, which appears to have been very great, we find, that he had five hundred she asses; and, in his prosperity, he is said to have had a thousand she asses. It is likely that the preference of females arose from the circumstance, that the ass can subsist on a scanty and coarse fare; so that, in the patriarchal ages, the she ass would not only bear the rider through the desert and barren tracts, but also, with her milk, contribute to the support of her master. Jair, the Gileadite, one of the judges of Israel, had thirty sons, who rode on thirty ass colts. Anah, the Horite prince, did not think it derogatory to his rank, to feed the asses of Zibeon, his father. In ancient times, the ass was used for drawing chariots: for, when Isaiah predicted the fall of Babylon, he describes the watchman as seeing "a chariot with a couple of horsemen, a chariot of asses, and a chariot of camels." Herodotus says, the Indians had war chariots drawn by wild asses.

The Jews considered the ass as an unclean animal, because his hoof was not cloven, and he did not chew the cud; therefore refrained from eating his flesh, and offering him as a sacrifice. But we find that, in cases of want, these laws were disregarded; for, when Samaria was besieged by the Syrians, "an ass's head was sold for fourscore pieces of silver." The contempt of the Jews for this beast did not cease with his existence; for, unlike other animals, which, when they died, were buried under ground, he was thrown into the fields or ditches, to be eaten by wild beasts or birds. Such also was the burial of their criminals, or those they wished to treat with ignominy; Jehoiakim, king of Judah, was doomed to be thus treated,—"He shall be buried with the burial of an ass, drawn and cast forth beyond the gates of Jerusalem."—***Supplement to the English edition of Cuvier's Animal Kingdom.***

[1] British Zoology, vol. i. p. 11.

[2] Mules have not unfrequently been known to bring forth young, especially in hot countries; and instances have not been wanting, though they are rare, both in England and Scotland. But it would require a succession of experiments to prove that mules will breed with each other, and produce an offspring equally capable of continuing the race. The common mule is very healthy, and will live above thirty years. It is found very serviceable in carrying burdens, particularly in mountainous and stony places, where horses are not so sure-footed. The size and strength of our breed have lately been much improved by the importation of Spanish male asses; and it were much to be wished, that the useful qualities of this animal were more attended to; for, by proper care in its breaking, its natural obstinacy would, in a great measure, be corrected; and it might be formed with success for the saddle, the draught, or the burden. People

larger, stronger, and better shaped. It is not yet well known whether the animal called the Gimerro be one of these kinds; or, as is asserted, bred between the ass and the bull. While naturalists affirm the impossibility of this mixture, the natives of the alpine countries, where this animal is bred, as strongly insist upon its reality. The common mule is very healthy, and will live above thirty years, being found very serviceable in carrying burdens, particularly in mountainous and stony places, where horses are not so sure-footed. The size and strength of our asses is at present greatly improved by the importation of Spanish jack-asses; and it is probable we may come in time to equal the Spaniards in breeding them, where it is not uncommon to give fifty or sixty guineas for a mule; and, indeed, in some mountainous countries, the inhabitants cannot well do without them. Their manner of going down the precipices of the Alps, or the Andes, is very extraordinary; and with it we will conclude their history. In these passages, on one side, are steep eminences, and, on the other, frightful abysses; and, as they generally follow the direction of the mountain, the road, instead of lying in a level, forms at every little distance steep declivities, of several hundred yards downward. These can only be descended by mules; and the animal itself seems sensible of the danger, and the caution that is to be used in such descents. When they come to the edge of one of these descents, they stop, without being checked by the rider; and, if he inadvertently attempts to spur them on, they continue immovable. They seem all this time ruminating on the danger that lies before them, and preparing themselves for the encounter. They not only attentively view the road, but tremble and snort at the danger. Having prepared for the descent, they place their fore-feet in a posture as if they were stopping themselves; they then also put their hinder-feet together, but a little forward, as if they were going to lie down. In this attitude, having taken as it were a survey of the road, they slide down with the swiftness of a meteor. In the meantime, all the rider has to do is to keep himself fast on the saddle, without checking the rein, for the least motion is sufficient to disorder the equilibrium of the mule; in which case they both unavoidably perish. But their address in this rapid descent, is truly wonderful; for in their swiftest motion when they seem to have lost all government of themselves, they follow exactly all the different windings of the road, as if they had previously settled in their minds the rout they were to follow, and taken every precaution for their safety. In this journey, the natives who are placed along the sides of the mountains, and hold by the roots of the trees, animate the beast with shouts, and encourage him to perseverance. Some mules, after being long used to these journeys, acquire a kind of reputation for their safety and skill; and their value rises in proportion to their fame.[1]

CHAP. III.

OF THE ZEBRA.

There are but three animals of the horse kind.[2] The horse, which is the most stately

---

of the first quality in Spain are drawn by mules, where fifty or sixty guineas is no uncommon price for one of them; nor is it surprising, when we consider how far they excel the horse in travelling in a mountainous country, the mule being able to tread securely where the former can hardly stand.

[1] Ulloa, vol. i.

[2] There are other two species of the horse genus, namely, the Dziggtai and the Quagga. The mountain zebra, and the zebra of the plains, are also different species. The mule may be regarded as a sub-species.

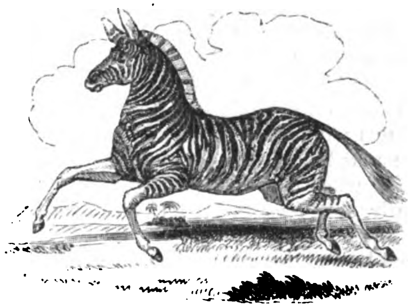
The *specific characters* of the *dziggtai* are.—his skin is isabella, or light bay in summer, of a clean and thriving appearance; of a redder hue in winter, and the hair very long; his mane and dorsal line, which enlarges on the crupper, are generally black; and his tail terminated by a black tuft. He is generally the size of an ordinary wild horse; and his proportions are intermediate between the horse and the ass. He is probably the wild mule of the ancients. He lives in troops in the sandy deserts of Central Asia. The flesh of this animal is esteemed a great delicacy by the Mongols, Tungooses, and other hordes, on the borders of the Great Desert. Like the rest of the genus he is gregarious, and is seen in troops of from twenty to thirty in number, and some have said even in herds of one hundred. Like the horse, his character is pacific, and he never attacks other animals. Each troop has a chief, who watches over its safety, conducts its general movements, and gives the signal of alarm, in cases of danger. This signal is said to consist in leaping several times round the object he dreads. This temerity often occasions his death: in which event the herd disperses, in opposite directions, and becomes more easily a prey to the hunters. It is in vain to attempt following the dziggtai on horseback, as it would quickly leave the fleetest courser of the desert far behind. It is remarkable, that all means to domesticate this animal have hitherto proved abortive, and this even when taken young. They are considered by the natives as untameable; for the individuals which have been tried generally killed themselves in their exertions to escape their thraldom. It has been found, however, that all animals are susceptible of some degree of domestication; and if this were persisted in, the dziggtai might eventually become a useful servant of man. Sonnini is of opinion, that this species will become extinct, from the circumstance of man not being able to subjugate them; and from their being such a favourite delicacy with the Asiatics.

The head and neck of the *Quagga* are dark blackish brown, the rest of a clear brown growing paler below, and underneath is nearly white, as well as the legs. The head and neck are striped with grayish white, longitudinal on the forehead and temples, and transvers-

and courageous; the ass, which is the most patient and humble; and the zebra, which is the most beautiful, but at the same time, the wildest animal in nature. Nothing can exceed the delicate regularity of this creature's colour, or the lustrous smoothness of its skin; but on the other hand, nothing can be more timid or more untameable.

It is chiefly a native of the southern parts of Africa; and there are whole herds of them often seen feeding in those extensive plains that lie towards the Cape of Good Hope. However, their watchfulness is such, that they will suffer nothing to come near them, and their swiftness so great, that they readily leave every pursuer far behind. The Zebra in shape rather resembles the mule, than the horse or the ass. It is rather less than the former, and yet larger than the latter. Its ears are not so long as those of the ass, and yet not so small as in the horse kind. Like the ass, its head is large, its back straight, its legs finely placed, and its tail tufted at the end; like the horse its skin is smooth and close, and its hind quarters round and fleshy. But its greatest beauty lies in the amazing regularity and elegance of its colours. In the male, they are white and brown; in the female, white and black. These colours are disposed in alternate stripes over the whole body, and with such exactness and symmetry, that one would think Nature had employed the rule and compass to paint them. These stripes which, like so many ribands, are laid all over its body, are narrow, parallel, and exactly separated from each other. It is not here as in other party coloured animals, where the tints are blended into each other; every stripe here is perfectly distinct, and preserves its colour round the body or the limb, withou any diminution. In this manner are the head, the body, the thighs, the legs, and even the tail and the ears, beautifully streaked, so that at a little distance one would be apt to suppose that the animal was dressed out by art, and not thus admirably adorned by nature.

In the male zebra, the head is striped with fine bands of black and white, which in a manner centre in the forehead. The ears are variegated with a white and dusky brown. The neck has broad stripes of the same dark brown running round it, leaving narrow white stripes between. The body is striped also cross the back with broad bands, leaving narrower spaces of white between them, and ending in points at the sides of the belly, which is white, except a black line pectinated on each side, reaching from between the fore-legs, along the middle of the belly, two thirds of its length. There



---

on the cheeks; between the mouth and eyes they form triangles; there are ten bands on the neck; the mane is blackish, short, much thicker than that of the zebra, commencing on the forehead, and is, like theirs, striped; a longitudinal black band runs from the termination of the mane along the spine, and loses itself in the tail, which is like that of a cow, with a dark brown or black tuft of hair at its extremity. The height of the quagga or couagga, is about four feet, or twelve hands, at the withers. In his form, proportions, lightness of figure, and smallness of head and ears, he bears a greater resemblance to the horse than the zebra, but his tail is like that of a cow. Quaggas associate in herds, frequently to the number of one hundred, in the most solitary regions of Southern Africa.

The *zebra of the plains* was first ascertained by Mr Burchell to be different from the common or mountain zebra. The following is Mr Gray's specific description of the zebra of the plains:—"Body white; head with numerous narrow brown stripes, which gradually unite together and form a bay nose, the neck and body with alternate broad stripes of black and narrow ones of brown, the latter of which nearly fill up the interstices between the black stripes, and only leave a narrow whitish margin. The dorsal line is narrow, and becomes gradually broader in the hinder part, distinctly margined with white on each side. The belly, legs, and all, quite white; the mane alternately banded with black and white." This beautiful animal differs materially from the common zebra; the ground colour of his body being entirely white, interrupted by a regular series of black stripes commencing on the ridge of the back, and terminating at the bottom of his sides: betwixt these are narrower and fainter ones of a brownish colour. On the shoulders and over the haunches, these stripes assume somewhat of a bifurcated appearance, between the divisions of which there are a few transverse lines of the same colour; but these suddenly and abruptly disappear, and are not continued on the legs, as in the common zebra, being perfectly white. Along the spinal ridge there is a narrow longitudinal line bordered on each side with white. The mane is long, stiff, and erect, with the transverse bands of the neck broadly continued through it, and distinctly tipped with deep black. The lines of the face are narrow, and perfectly regular; from the centre of the forehead they radiate downwards over each eye; along the front of the muzzle they are longitudinal, with the outer ones slightly curved outwards; and on the sides they form broader transverse fillets. From where the bands unite on the extremity of the muzzle, the nose, and the upper lip, those parts become nearly of a uniform blackish brown. The tail is of a yellowish white. There is no longitudinal ventral line; and the back part of the ears are occupied towards the tips by patches of black. The hoofs are moderately large, deep in front, and shallow behind, and considerably expanded at their margin.

is a line of separation between the trunk of the body and the hinder quarters, on each side: behind which, on the rump, is a plat of narrow stripes, joined together by a stripe down the middle, to the end of the tail. The colours are different in the female; and in none the stripes seem entirely to agree in form, but in all they are equally distinct; the smooth hair equally and fine; the white shining and unmixed; and the black, or brown, thick and lustrous.

Such is the beauty of this creature, that it seems by nature fitted to satisfy the pride and the pleasure of man: and formed to be taken into his service. Hitherto, however, it appears to have disdained servitude; and neither force nor kindness have been able to wean it from its native independence and ferocity. But this wildness might, perhaps, in time be surmounted: and it is probable the horse and the ass, when first taken from the forest, were equally obstinate, fierce, and unmanageable. Mr Buffon informs us, that the zebra from which he took his description could never be entirely mastered, notwithstanding all the efforts which were tried to tame it. They continued, indeed, to mount it, but then with such precautions as evidently showed its fierceness, for two men were obliged to hold the reins, while the third ventured upon its back; and even then it attempted to kick, whenever it perceived any person approaching. That which is now in the Queen's menagerie at Buckingham-Gate, is even more vicious than the former; and the keeper who shows it takes care to inform the spectators of its ungovernable nature. Upon my attempting to approach it, it seemed quite terrified, and was preparing to kick, appearing as wild as if just caught, although taken extremely young, and used with the utmost indulgence. Yet still it is most probable that this animal, by time and assiduity, could be brought under subjection. As it resembles the horse in form, without all doubt it has a similitude of nature, and only requires the efforts of an industrious and skilful nation, to be added to the number of our domestics. It is not *now* known what were the pains and dangers which were first undergone to reclaim the breed of horses from savage ferocity; these, no doubt, made an equal opposition; but by being opposed by an industrious and enterprising race of mankind, their spirit was at last subdued, and their freedom restrained. It is otherwise with regard to the zebra; it is the native of countries where the human inhabitants are but little raised above the quadruped. The natives of Angola, or Caffraria, have no other idea of advantage from horses but as they are good for food; neither the fine stature of the Arabian courser, nor the delicate colourings of the zebra, have any allurements to a race of people, who only consider the quantity of flesh, and not its conformation. The delicacy of the zebra's shape, or the painted elegance of its form, are no more regarded by such, than by the lion that makes it his prey. For this reason, therefore, the zebra may hitherto have continued wild, because it is the native of a country where there have been no successive efforts made to reclaim it. All pursuits that have been hitherto instituted against it, were rather against its life than its liberty: the animal has thus been long taught to consider man as its most mortal enemy; and it is not to be wondered that it refuses to yield obedience where it has so seldom experienced mercy. There is a kind of knowledge in all animals, that I have often considered with amazement; which is, that they seem perfectly to know their enemies, and to avoid them. Instinct, indeed, may teach the deer to fly from the lion; or the mouse to avoid the cat; but what is the principle that teaches the dog to attack the dog-butcher wherever he sees him? In China, where the killing and dressing of dogs is a trade, whenever one of those people moves out, all the dogs of the village or the street are sure to be after him. This I should hardly have believed, but that I have seen more than one instance of it among ourselves. I have seen a poor fellow who made a practice of stealing and killing dogs for their skins, pursued in full cry for three or four streets together, by all the bolder breed of dogs, while the weaker flew from his presence with affright. How these animals could thus find out their enemy, and pursue him, appears, I own, unaccountable, but such is the fact; and it not only obtains in dogs, but in several other animals, though perhaps to a less degree. This very probably may have been in some measure a cause that has hitherto kept the zebra in its state of natural wildness; and in which it may continue, till kinder treatment shall have reconciled it to its pursuers.

It is very likely, therefore, as a more civilized people are now placed at the Cape of Good Hope, which is the chief place where this animal is found, that we may have them tamed and rendered serviceable. Nor is its extraordinary beauty the only motive we have for wishing this animal among the number of our dependents: its swiftness is said to surpass that of all others; so that the speed of a zebra is become a proverb among the Spaniards and Portuguese. It stands better upon its legs also than a horse; and is consequently stronger in proportion. Thus, if by proper care we improve the breed, as we have in other instances, we should probably in time to come have a race as large as the horse, as fleet, as strong, and much more beautiful.

The zebra, as was said, is chiefly a native of the Cape of Good Hope. It is also found in the kingdom of Angola; and, as we are assured by Lopez, in several provinces also of Barbary. In those boundless forests it has nothing to restrain its liberty; it is too shy to be caught in traps, and therefore seldom taken alive. It would seem, therefore, that none of them have ever been brought into Europe, that were caught sufficiently young, so as to be untinctured by their original state of wildness. The Portuguese, indeed, pretend that they have been able to tame them, and that they have sent four from Africa to Lisbon, which were so far brought under, as to draw the king's coach:[1] they add, that the person who sent them over, had the office of notary conferred upon him for his reward, which was to remain to him and his posterity for ever: but I do not find this confirmed by any person who says he saw them. Of those which were sent to Brazil, not one could be tamed; they would permit one man only to approach them; they were tied up very short; and one of them, which had by some means got loose, actually killed his groom, having bitten him to death.[2] Notwithstanding this, I believe, were the zebra taken up very young, and properly treated, it might be rendered as tame as another animal; and Merolla, who saw many of them, asserts, that when tamed, which he speaks of as being common enough, they are not less estimable for their swiftness than their beauty.

This animal, which is neither to be found in Europe, Asia, nor America, is nevertheless very easily fed. That which came over into England some years ago, would eat almost any thing, such as bread, meat, and tobacco; that which is now among us, subsists entirely upon hay. As it so nearly resembles the horse and the ass in structure, so it probably brings forth annually as they do. The noise they make is neither like that of a horse nor an ass, but more resembling the confused barking of a mastiff dog. In the two which I saw, there was a circumstance that seems to have escaped naturalists; which is, that the skin hangs loose below the jaw upon the neck, in a kind of dewlap, which takes away much from the general beauty. But whether this be a natural or accidental blemish, I will not take upon me to determine.

These animals are often sent as presents to the princes of the East. We are told, that one of the governors of Batavia gave a zebra, which had been sent to him from Africa, to the emperor of Japan, for which he received, as an equivalent for the company, a present, to the value of sixty thousand crowns.[3] Teller also relates, that the Great Mogul gave two thousand ducats for one of them. And it is frequent with the African ambassadors to the court of Constantinople, to bring some of these animals with them, as presents for the Grand Signior.[4]

---

[1] Dapper.

[2] Pyrard. tom. ii. p. 376.

[3] Navendort.

[4] Three instances have occurred in Europe of female zebras producing mules. The first took place in this country. Lord Clive, on his return from India, brought with him a female zebra from the Cape. The experiment was first tried with an Arab horse, but failed. Asses were then tried but with no better effect. At last, by painting one of these asses like a zebra, the plan succeeded. The result was a foal, which resembled both father and mother. It had the form of the first, and the colour of the second, excepting that the tints were not so strongly marked. After his lordship's death, this mule was lost sight of, and its fate is unknown. The second instance took place at Turin, between an ass and a female zebra, but the offspring did not survive. The third instance took place in the menagerie of Paris. From a female zebra and a Spanish ass of the largest size, proceeded a very well-formed mule. This animal proved a little larger than the mother, but as it grew up, had much of the form of the father. It was excessively docile. The experiment was then repeated with a horse. Conception took place, but in the eighth month of gestation the zebra died. On opening the body, a male foetus was found, without hair, but having the head marked with black and white stripes.—*Griffith.*

A

HISTORY OF ANIMALS.

BOOK II.

OF RUMINATING ANIMALS.

CHAP. I.

INTRODUCTION.

Of all animals, those that chew the cud are the most harmless, and the most easily tamed. As they live entirely upon vegetables, it is neither their interest nor their pleasure to make war upon the rest of the brute creation; content with the pastures where they are placed, they seldom desire to change, while they are furnished with a proper supply; and fearing nothing from each other, they generally go in herds for their mutual security. All the fiercest of the carnivorous kinds seek their food in gloomy solitude; these, on the contrary, range together; the very meanest of them are found to unite in each other's defence; and the hare itself is a gregarious animal, in those countries where it has no other enemies but the beasts of the forest to guard against.

As the food of ruminant animals is entirely of the vegetable kind, and as this is very easily procured, so these animals seem naturally more indolent and less artful than those of the carnivorous kinds; and as their appetites are more simple, their instincts seem to be less capable of variation. The fox or the wolf are for ever prowling; their long habits of want give them a degree of sharpness and cunning; their life is a continued scene of stratagem and escape: but the patient ox, or the deer, enjoy the repast that nature has abundantly provided; certain of subsistence, and content with security.

As nature has furnished these animals with an appetite for such coarse and simple nutriment, so she has enlarged the capacity of the intestines, to take in a greater supply. In the carnivorous kinds, as their food is nourishing and juicy, their stomachs are but small, and their intestines short; but in these, where pasture is coarse, and where much must be accumulated before any quantity of nourishment can be obtained, their stomachs are large and numerous, and their intestines long and muscular. The bowels of a ruminating animal may be considered as an elaboratory, with vessels in it, fitted for various transmutations. It requires a long and tedious process before grass can be transmuted into flesh; and for this purpose, nature, in general, has furnished such animals as feed upon grass with four stomachs, through which the food successively passes and undergoes the proper separations.[1]

Of the four stomachs with which ruminant animals are furnished, the first is called the *paunch*, which receives the food after it has been slightly chewed; the second is called the *honey-comb*, and is properly nothing more than a continuation of the former; these two, which are very capacious, the animal fills as fast as it can, and then lies down to ruminate; which may be properly considered as a kind of vomiting without effort or pain. The two stomachs above mentioned being filled with as much as they can contain, and the grass, which was slightly chewed, beginning to swell with the heat of the situation, it dilates the stomachs, and these again contract upon their contents. The aliment, thus squeezed, has but two passages to escape at; one into the third stomach, which is very narrow; and the other back, by the gullet, into the mouth, which is wider. The greatest quantity, therefore, is driven back, through the largest aperture, into the mouth, to be chewed a second time; while a small part, and that only the most liquid, is driven into the third stomach, through the orifice which is so small. The food which is driven to the mouth, and chewed a second time, is thus rendered more soft and moist, and becomes at last liquid enough to pass into the conduit that goes to the third stomach, where it undergoes a still farther comminution. In this stomach, which is called the *manifold*, from the number of its leaves, all which tend to promote digestion, the grass has the appearance of boiled spinnage, but not yet sufficiently reduced, so as to make a part of the animal's nourishment; it requires the operation of the fourth stomach for this purpose, where it undergoes a complete maceration, and is separated to be turned into chyle.

---

[1] All quadrupeds that chew the cud have suet instead of the soft fat of other animals; and they have the awkward habit of rising, when in a recumbent posture, upon their hind legs first. A cow, when she rises from the ground, places herself on the fore-knees, and then lifts up the whole hinder parts. A horse springs up first on his fore-legs, and then raises up his hinder parts. This may be owing to the different conformation of the stomach.—*Note by Goldsmith.*

But nature has not been less careful in another respect, in fitting the intestines of these animals for their food. In the carnivorous kinds they are thin and lean; but in ruminating animals they are strong, fleshy, and well covered with fat. Every precaution seems taken that can help their digestion: their stomach is strong and muscular, the more readily to act upon its contents; their intestines are lined with fat, the better to preserve their warmth; and they are extended to a much greater length, so as to extract every part of that nourishment which their vegetable food so scantily supplies.

In this manner are all quadrupeds of the cow, the sheep, or the deer kind, seen to ruminate; being thus furnished with four stomachs, for the macerating of their food. These, therefore, may most properly be called the *ruminant kinds;* although there are many others that have this quality in a less observable degree. The rhinoceros, the camel, the horse, the rabbit, the marmotte, and the squirrel, all chew the cud by intervals, although they are not furnished with stomachs like the former. But not these alone, there are numberless other animals that appear to ruminate; not only birds but fishes and insects. Among birds are the pelican, the stork, the heron, the pigeon, and the turtle; these have a power of disgorging their food to feed their young. Among fishes are lobsters, crabs, and that fish called the *dorado.* The salmon also is said to be of this number: and, if we may believe Ovid, the *scarus* likewise; of which he says,[1]

> Of all the fish that grase beneath the flood,
> He *only* ruminates his former food.

Of insects, the ruminating tribe is still larger; the mole, the cricket, the wasp, the drone. the bee, the grasshopper, and the beetle. All these animals either actually chew the cud, or seem at least to ruminate. They have the stomach composed of muscular fibres, by means whereof the food is ground up and down, in the same manner as in those which are particularly distinguished by the appellation of *ruminants.*

But not these alone; men themselves have been often known to ruminate, and some even with pleasure. The accounts of these calamities, for such I must consider them, incident to our fellow-creatures, are not very pleasant to read: yet I must transcribe a short one, as given us by Slare, in the Philosophical Transactions, as it may, in some measure, show the satisfaction which the lower tribes of animals enjoy while they ruminate. The man in question was a citizen of Bristol, of about twenty years of age, and, what seemed more extraordinary still, of a ruminating family, for his father was frequently subject to the same infirmity, or amusement, as he himself perhaps would call it. This young man usually began to chew his meat over again within about a quarter of an hour after eating. His ruminating after a full meal generally lasted about an hour and a half; nor could he sleep until his task was performed. The victuals, upon the return, tasted even more pleasantly than at first; and returned as if they had been beaten up in a mortar. If he ate a variety of things, that which he ate first came up again first; and if this return was interrupted for any time, it produced sickness and disorder, and he was never well till it returned. Instances of this kind, however, are rare and accidental; and it is happy for mankind that they are so. Of all other animals, we spend the least time in eating; this is one of the great distinctions between us and the brute creation; and eating is a pleasure of so low a kind, that none but such as are nearly allied to the quadruped, desire its prolongation.

CHAP. II.

OF QUADRUPEDS OF THE COW KIND.[2]

Of all ruminant animals, those of the cow kind deserve the first rank, both for their size, their beauty, and their services. The horse is more properly an animal belonging to the rich; the sheep chiefly thrives in a flock, and requires attendance; but the cow is more especially the poor man's pride, his riches, and his support. There are many of our peasantry that have no other possession but a cow; and even of the advantages resulting from this most useful creature, the poor are but the nominal possessors. Its flesh they cannot pretend to taste, since then their whole riches are at once destroyed; its calf they are obliged to fatten for sale, since veal is a delicacy they could not make any pretensions to; its very milk is wrought into butter and cheese for the tables of their masters; while they have no share, even in their own possessions, but the choice of their market. I cannot bear to hear the rich crying out for liberty while they thus starve their fellow-creatures, and feed them up with an imaginary good, while they monopolize the real benefits of nature.

---

[1] At contra herbosa pisces laxantur arena.
Ut scarus epastus *solus* qui ruminant escas.

[2] The animals of this kind have the horns hollow, smooth, turned outwards and forwards, in a semicircular form; in the lower jaw there are eight front teeth, but none in the upper: and there are no tusks in either.

In those countries where the men are under better subordination, this excellent animal is of more general advantage. In Germany, Poland, and Switzerland, every peasant keeps two or three cows, not for the benefit of his master, but for himself. The meanest of the peasants there kills one cow at least for his own table, which he salts and hangs up, and thus preserves as a delicacy all the year round. There is scarcely a cottage in those countries that is not hung round with these marks of hospitality; and which often make the owner better contented with hunger, since he has it in his power to be luxurious when he thinks proper. A piece of beef hung up there is considered as an elegant piece of furniture, which, though seldom touched, at least argues the possessor's opulence and ease. But it is very different, for some years past, in this country, where our lower rustics at least are utterly unable to purchase meat any part of the year, and by them even butter is considered as an article of extravagance.

The climate and pasture of Great Britain, however, are excellently adapted to this animal's moderate nature; and the verdure and the fertility of our plains are perfectly suited to the manner of its feeding; for, wanting the upper teeth, it loves to graze on a high rich pasture. This animal seems but little regardful of the quality of its food, provided it be supplied in sufficient abundance; it makes no particular distinction in the choice of its herbage, but indiscriminately and hastily devours the proper quantity. For this reason, in our pastures, where the grass is rather high than succulent, more flourishing than nutritious, the cow thrives admirably; and there is no part of Europe where the tame animal grows larger, yields more milk, or more readily fattens, than with us.

Our pastures supply them with abundance, and they in return enrich the pastures; for, of all animals, the cow seems to give back more than it takes from the soil. The horse and the sheep are known, in a course of years, to impoverish the ground. The land where they have fed becomes weedy, and the vegetables coarse and unpalatable; on the contrary, the pasture where the cow has been bred, acquires a finer, softer surface, and becomes every year more beautiful and even. The reason is, that the horse being furnished with fore-teeth in the upper jaw, nips the grass closely, and therefore only chooses that which is the most delicate and tender; the sheep also, though, with respect to its teeth, formed like the cow, only bites the most succulent parts of the herbage: these animals, therefore, leave all the high weeds standing; and while they cut the finer grass too closely, suffer the ranker herbage to vegetate and overrun the pasture. But it is otherwise with the cow: as its teeth cannot come so close to the ground as those of the horse, nor so readily as those of the sheep, which are less, it is obliged to feed upon the tallest vegetables that offer; thus it eats them all down, and in time, levels the surface of the pasture.

The age of the cow is known by the teeth and horns. This animal is furnished with eight cutting teeth in the lower jaw; at the age of ten months the two middlemost of these fall out, and are replaced by others that are not so white, but broader; at the age of sixteen months the two next milk-white teeth fall out likewise, and others come up in their room; thus, at the end of every six months, the creature loses and gains, till at the age of three years all the cutting-teeth are renewed, and then they are long, pretty white, and equal; but in proportion as the animal advances in years, they become irregular and black, their inequalities become smoother, and the animal less capable of chewing its food. Thus the cow often declines from this single cause; for as it is obliged to eat a great deal to support life, and as the smoothness of the teeth makes the difficulty of chewing great, a sufficient quantity of food cannot be supplied to the stomach. Thus the poor animal sinks in the midst of plenty, and every year grows leaner and leaner, till it dies.

The horns are another and a surer method of determining this animal's age. At three years old it sheds its horns,[1] and new ones arise in their place, which continue as long as it lives; at four years of age, the cow has small pointed, neat, smooth horns, thickish near the head; at five, the horns become larger, and are marked round with the former year's growth. Thus, while the animal continues to live, the horns continue to lengthen; and every year a new ring is added at the root; so that allowing three years before their appearance, and then reckoning the number of rings, we have, in both together, the animal's age exactly.

---

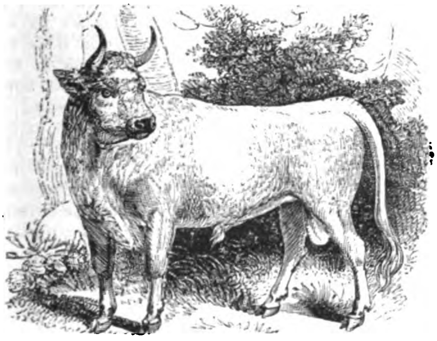
[1] The horns are not cast; but at the age of three years, the animal rubs off a very slight external shell coating from them.

As we have indisputably the best breed of horned cattle of any in Europe, so it was not without the same assiduity that we came to excel in these, as in our horses. The breed of cows has been entirely improved by a foreign mixture, properly adapted to supply the imperfections of our own. Such as are purely British are far inferior in size to those on many parts of the continent; but those which we have thus improved by far excel all others. Our Lincolnshire kind derive their size from the Holstein breed: and the large hornless cattle that are bred in some parts of England came originally from Poland. We were once famous for a wild breed of these animals, but these have long since been worn out; and perhaps no kingdom in Europe can furnish so few wild animals of all kinds as our own.[1] Cultivation and agriculture are sure to banish these wherever they are found; and every addition a country receives from art drives away those animals that are only fitted for a state of nature.

Of all quadrupeds the cow seems most liable to alteration from its pasture. In the different parts of our own country we easily perceive the great varieties produced among these animals, by the richness or poverty of the soil. In some they grow to a great bulk; and I have seen an ox sixteen hands high, which is taller than the general run of our horses. In others they appear as diminutive; being not so large as an ass. The breed of the Isle of Man, and most parts of Scotland, is much less in general than in England or Ireland: they are differently shaped also, the dewlap being much smaller, and, as the expression is, the breast has more of the ewe neck. This, till some years ago, was not considered in cattle as a deformity; and the cow was chosen according to Virgil's direction, with a large dewlap: however, at present it is the univeral opinion, that the cow wants in udder, what it has in neck; and the larger the dewlap, the smaller is the quantity of its milk. Our graziers now, therefore, endeavour to mix the two breeds; the large Holstein with the small northern; and from both results that fine milch breed, which excels the cattle of any other part of the world.

This difference, arising from pasture, is more observable in other countries than in our own. The cow kind is to be found in almost every part of the world, large in proportion to the richness of the pasture; and small as the animal is stinted in its food. Thus Africa is remarkable for the largest and the smallest cattle of this kind; as is also India, Poland, Switzerland, and several other parts of Europe. Among the Eluth Tartars, where the pastures

---



[1] The *White Urus* (*Urus Scoticus*) is a wild breed of the ox, the probable remains of the genuine Urus. It is of a small size, and ranged formerly through the woods of southern Scotland and the north of England. When this breed was exterminated from the open forests is unknown; but some time before the reformation, the remnants were already confined in parks belonging to ecclesiastical establishments, from whence they were transferred at the dissolution to that of Drumlanrig, and other places. Those in the park of Burton Constable were all destroyed in the middle of the last century by a distemper. The race is entirely of a white colour; the muzzle invariably black; the inside of the ear, and about one-third part of the out side from the tip downwards, red; the horns are white with black tips of a fine texture, and as in the fossil skull, bent downwards. Bulls weigh from thirty-five to forty-five stone, and cows from twenty-five to thirty-five, fourteen pounds to the stone. Before they were kept in parks, they were probably larger and more rugged; old bulls still acquire a kind of mane about two inches long, and their throat and breast is covered with coarser hair. Those of Burton Constable differed from the others, they having the ears and tips of the tail black. Their manners differ from domestic oxen, and may be in part those of the ancient urus. Upon perceiving a stranger they gallop widely in a circle round him, and stop to gaze, tossing their heads, and showing signs of defiance: they then set off, and gallop a second time round, but in a contracted circle, repeating this circular mode of approaching till they are so near that it becomes prudent to retire from their intended charge. The cows conceal their young calves for eight or ten days, going to suckle them twice or three times in a day: if a person comes near the calf, it conceals itself by crouching. One not more than two days old being discovered by Dr Fuller, was very lean and weak. On his stroking its head, it got up, pawed the ground, bellowed very loud, went back a few steps, and bolted at his legs: it then began to paw again, and made another bolt, but missing its aim, fell, and was so weak as not to be able to rise; but by this time, its bellowing had roused the herd, which came instantly to its relief, and made the doctor retire. When one of this breed happens to be wounded, or is enfeebled by age, or sickness, the others set upon it and gore it to death. Breeds of them are still preserved in the Cadzow Forest belonging to the Duke of Hamilton, in Lanarkshire, and in the park of Chillingham Castle, near Berwick-upon-Tweed; they also used to be preserved at Wollaton, in Nottingham; at Gisburne, in Craven: at Limehall, in Chesshire, and at Chartly, in Staffordshire.

are remarkably rich and nourishing, the cow becomes so large that he must be a tall man who can reach the tip of its shoulder. On the contrary, in France, where the animal is stinted in its food, and driven from the most flourishing pastures, it greatly degenerates.[1]

But the differences in the size of this animal are not so remarkable as those which are found in its form, its hair, and its horns. The difference is so very extraordinary in many of them, that they have been even considered as a different kind of creature, and names have been given them as a distinct species, when

---

[1] The breeds of the Kisguise and Calmuck Tartars, those of Podolia and Ukraine, of European Turkey, of Hungary, and of the Roman States, are among the largest known. They are nearly all distinguished by ample horns spreading sideways, then forwards and upwards, with dark points: their colour is a bluish-ash passing to black. That in the Papal dominions is not found represented on the ancient bas-reliefs of Rome, but was introduced most probably by the Goths, or at the same time with the buffalo. Italy possesses another race, presumed to have existed in the Pagan times, valued for its fine form and white colour: it is not so large, but the horns are similarly developed. Tuscany produces this race, and droves of them were transplanted to Cuba and imported into Jamaica.

Ancient Egypt nourished a large, white breed, which, however, is not the most common upon the monuments of that country, where the cattle are usually represented with large irregular marks of black or brown upon a white ground.

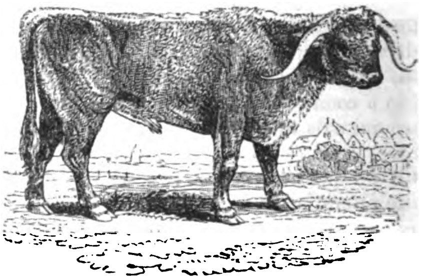
In Abyssinia there is also a large white breed, but the greater number are variously coloured. The Caffres and Hottentots rear a fine race, likewise marked with large brown or black clouds: some are of extraordinary size, with the horns directed forward and upwards. It is from these that their Bakely, or war oxen, are chosen: they ride them on all occasions, being quick, persevering, extremely docile, and governed by the voice or a whistle of the owners with surprising intelligence. They thrive most on the *Zuure Velden* or saline pastures, and that kind of food may cause the peculiarly fetid smell of their breath, noticed by Mr Barrow. The long horns of some of this breed are often trained by the Namaguas and other tribes, so as to twist in spiral curves or other fanciful forms, said to be managed by means of a warm iron.

Denmark rears a breed of large stature, which most likely produced the tall Dutch race, of which we have seen one weighing a thousand pounds; from this race sprung the Holstein, which was the parent of the old unimproved English breeds; the Vandals or Goths may have conducted it into Spain, and left its traces in the large breeds of Salamanca, and transported from thence to South America, furnished the root of the fine races which cover the Pampas, near Buenos Ayres, and in Cuba; while the large English supplied that of the United States.

Breeds with small and middle-sized horns exist in the Crimea, in a great part of Germany, Sweden, France, England, Italy, and Spain; and the Polled races, or hornless cattle, originally, as it would appear, a German breed, "ne armentis quidem honor aut gloria frontis,' according to Tacitus, have spread to Iceland and Norway, where they are often fed on dried fish. They are now abundant in Scotland, exist in France, and about Penaranda, in Spain, from whence they may have been transported to form the Polled breed of Assomption in Paraguay. They are also common in Abyssinia and Madagascar.

The races of France are principally distinguished into two divisions, among both of which fine breeds are found. The first is commonly designated as *Bœufs de haut cru*, or those who are of middle or small stature; with a fierce look, thick hide, coarse hair, large dewlap, horns greenish or black; living in the mountainous departments formed of the ancient provinces of Limousin, Saintonge, Andoumois, Marche, Berri, Gascony, Auvergne, Bourbonois, Charolois, and Burgundy. The others are styled *Bœufs de Nature*. Their stature is large or middle sized, head and body small, ears and muzzle fine; horns white, hide thin; hair soft, and aspect kind: they fatten easily, and belong to low or level lands.

We now proceed to describe the different breeds of cows cultivated in Britain. They are very numerous, but we shall only notice such as are in most esteem. These different breeds are generally distinguished by the length or flexure of their horns; by the absence of horns; by the districts where they are supposed to have originated, or in which they abound, or exist in the greatest purity; or by the name of the breeder.



The long-horned or Lancashire breed of cattle is distinguished from others by the length of their horns, the thickness and firm texture of their hides, the length and closeness of their hair, the large size of their hoofs, and their coarse, leathery, thick necks: they are likewise deeper in their fore quarters, and lighter in their hind quarters, than most other breeds; narrower in their shape, less in point of weight than the short horns, though better weighers in proportion to their size; and though they give considerably less milk, it is said to afford more cream in proportion to its quantity. They are more varied in their colour than any of the other breeds; but, whatever the colour be, they have in general a white streak along their back, which the breeders term finched, and mostly a white spot on the inside of the hough. In a general view, this race, notwithstanding the singular efforts that have been made towards its improvement, remains with little alteration; for, except in Leicestershire, none of the subvarieties (which differ a little in almost every one of those counties where the long horns prevail) have undergone any radical change or any obvious improvement. The improved breed of Leicestershire is said to have been formed by Webster, of Cauley, near Coventry, in Warwickshire, by means of six cows brought from the banks of the Trent, about the beginning of the present century, which were crossed with bulls from Westmoreland and Lancashire. Bakewell of Dishley, in Leicestershire, afterwards got the lead as a breeder, by selecting from the Cauley stock; and the stocks of several other eminent breeders have been traced to the same source.

The short-horned, sometimes called the Dutch breed, is known by a variety of names, taken from the districts where they form the principal cattle stock, or where most attention has been paid to their improvement;

in reality they are all the same. In this manner the urus and the bison have been considered, from the variety in their make, to be distinct in their production; but they are all, in fact, the descendants of one common stock, as they have that certain mark of unity, they breed and propagate among each other. Naturalists have, therefore, laboured under an

---

thus, different families of this race are distinguished by the names of the *Holderness*, the *Teeswater*, the *Yorkshire*, *Durham*, *Northumberland*, and other breeds. The Teeswater breed, a variety of short horns, established on the banks of the Tees, at the head of the vale of York, is at present in the highest estimation, and is alleged to be the true Yorkshire short-horned breed. Bulls and cows from this stock, purchased at most extraordinary prices, are spread over all the north of England, and the border counties of Scotland. The bone, head, and neck of these cattle are fine; the hide is very thin; the chine full; the loin broad; the carcase throughout large and well fashioned; and the flesh and fatting quality equal, or perhaps superior, to those of any other large breed. The short-horns give a greater quantity of milk than any other cattle; a cow usually yielding twenty-four quarts per day, making three firkins of butter during the grass season: their colours are much varied, but they are generally red and white mixed, or what the breeders call flecked. The heaviest and largest oxen of the short-horned breed, when properly fed, victual the East India ships, as they produce the thickest beef, which, by retaining its juices, is the best adapted for such long voyages. Our royal navy should also be victualled from these; but, from the jobs made by contractors, and from other abuses, it is feared our honest tars are often fed with beef of an inferior quality; however, the coal ships from Newcastle, Shields, Sunderland, &c., are wholly supplied with the beef of these valuable animals. These oxen commonly weigh from 60 to 100 stone (14 lbs. to the stone); and they have several times been fed to 120, 130, and some particular ones to upwards of 150 stone.

In comparing the breeds of long and short horned cattle, Culley observes that the long-horns excel in the thickness and firm texture of the hide, in the length and closeness of the hair, in their beef being finer-grained, and more mixed and marbled than that of the short-horns, in weighing more in proportion to their size, and in giving richer milk; but they are inferior to the short-horns, in giving a less quantity of milk, in weighing less upon the whole, in affording less tallow when killed, in being generally slower feeders, and in being coarser made and more leathery or bullish in the under side of the neck. In few words, says he, the long-horns excel in the hide, hair, and quality of the beef; the short-horns in the quantity of beef, tallow, and milk. Each breed has long had, and probably may have, its particular advocates; but if he may hazard a conjecture, is it not probable that both kinds may have their particular advantages in different situations? Why may not the thick firm hides, and long close-set hair, of the one kind, be a protection and security against those impetuous winds and heavy rains to which the west coast of this island is so subject; while the more regular seasons and mild climate upon the east coast are more suitable to the constitutions of the short-horns.

The middle-horned breeds comprehend, in like manner, several local varieties, of which the most noted are the *Devons*, the *Sussexes*, and the *Herefords*; the last two, according to Culley, being varieties of the first, though of a greater size, the Herefords being the largest. These cattle are the most esteemed of all our breeds for the draught, on account of their activity and hardiness; they do not milk so well as the short-horns, but are not deficient in the valuable property of feeding at an early age, when not employed in labour.

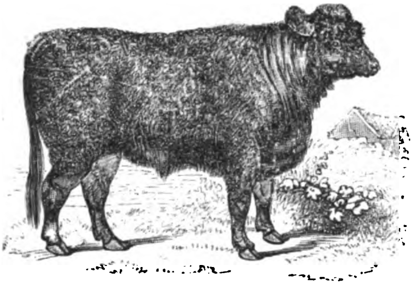
The Devonshire cattle are of a high red colour (if any white spots they reckon the breed impure, particularly if those spots run one into another), with a light-dun ring round the eye, and the muzzle of the same colour, fine in the bone, clean in the neck, horns of a medium length, bent upwards, thin-faced, and fine in the chops, wide in the hips, a tolerable barrel, but rather flat on the sides, tail small, and set on very high; they are thin-skinned, and silky in handling, feed at an early age, or arrive at maturity sooner than most other breeds. Another author observes, that they are a model for all persons who breed oxen for the yoke. The weight of the cows is usually from thirty to forty stone, and of the oxen from forty to sixty; the North Devon variety, in particular, from the fineness in the grain of the meat, is held in high estimation in Smithfield.

Lawrence says that the race of red cattle of North Devon and Somerset is doubtless one of our original breeds, and one of those which have preserved most of their primitive form; the excellence of this form for labour is best proved by the fact, that the fashionable substitution of horses has made no progress in the district of these cattle, by their high repute as feeders, and for the superior excellence of their beef, which has been acknowledged for ages. They are, he says, the speediest working-oxen in England, and will trot well in harness; in point of strength, they stand in the fourth or fifth class. They have a greater resemblance to deer than any other breed of neat cattle. They are rather wide than middle-horned, as they are sometimes called; some, however, have regular middle-horns, that is, neither short nor long, turned upward and backward at the points. As milkers, they are so far inferior to both the long and short horns, both in quantity and quality of milk, that they are certainly no objects for the regular dairy, however pleasing and convenient they may be in the private family way.

The Sussex and Herefordshire cattle are of a deep red colour, with fine hair and very thin hides; neck and head clean, the face usually white; horns neither long nor short, rather turning up at the points; in general, they are well made in the hind quarters, wide across the hips, rump, and sirloin, but narrow in the chine; tolerably straight along the back, ribs too flat, thin in the thigh, and bone not large. An ox, six years old, will weigh when fat, from sixty to 100 stone, the fore-quarters generally the heaviest: the oxen are mostly worked from three to six years old, sometimes till seven, when they are turned off for feeding. The Hereford cattle are next in size to the Yorkshire short-horns: both this and the Gloucester variety are highly eligible as dairy stock, obvious error, when, because of the extreme bulk of the urus, or because of the lump upon the back of the bison, they assigned them different places in the creation, and separated a class of animals which was really united. It is true, the horse and the ass do not differ so much in form, as the cow and the bison; nevertheless, the former are distinct animals,

---

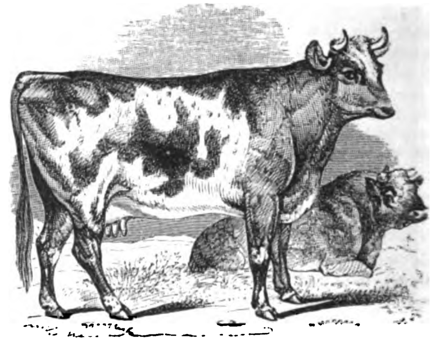
and the females of the Herefords have been found to fatten better at three years old than any other kind of cattle except the spayed heifers of Norfolk.



The polled or hornless breeds. The most numerous and esteemed variety is the Galloway breed, so called from the province of that name, in the south-west of Scotland, where they most abound. The true Galloway bullock is straight and broad on the back, and nearly level from the head to the rump, broad at the loins, not, however, with hooked bones, or projecting knobs, so that when viewed from above, the whole body appears beautifully rounded; he is long in the quarters, but not broad in the twist; he is deep in the chest, short in the leg, and moderately fine in the bone, clean in the chop and in the neck; his head is of a moderate size, with large rough ears, and full but not prominent eyes, or heavy eyebrows, so that he has a calm though determined look; his well proportioned form is clothed with a loose and mellow skin, adorned with long soft glossy hair. The prevailing colour is black or dark brindled, and, though they are occasionally found of every colour, the dark colours are uniformly preferred, from a belief that they are connected with superior hardiness of constitution. The Galloways are rather undersized, not very different from the size of the Devons, but as much less than the long-horns, as the long-horns are less than the short-horns. On the best farms, the average weight of bullocks three years and a half old, when the greater part of them are driven to the south, has been stated at about forty stone, avoirdupois; and some of them, fattened in England, have been brought to nearly 100 stone.

The general properties of this breed are well known in almost every part of England, as well as in Scotland. They are sometimes sent from their native pastures directly to Smithfield, a distance of four hundred miles, and sold at once to the butcher; and in spring they are often shown in Norfolk, immediately after their arrival, in as good condition as, or even better than, when they began their journey; with full feeding, there is perhaps no breed that sooner attains maturity, and their flesh is of the finest quality. Culley was misinformed about the quantity of milk they yield, which, though rich, is by no means abundant. It is alleged not to be more than seventy or eighty years since the Galloways were all horned, and very much the same in external appearance and character with the breed of black cattle which prevailed over the west of Scotland at that period, and which still abounds in perfection, the largest-sized ones in Argyleshire, and the smaller in the Isle of Sky. The Galloway cattle at the time alluded to were coupled with some hornless bulls, of a sort which do not seem now to be accurately known, but which were then brought from Cumberland, the effects of which crossing were thought to be the general loss of horns in the former, and the enlargement of their size: the continuance of a hornless sort being kept up by selecting only such for breeding, or perhaps by other means, as by the practice of eradicating with the knife the horns in their very young state.

The Suffolk duns, according to Culley, are nothing more than a variety of the Galloway breed. He supposes them to have originated in the intercourse that has long subsisted between the Scotch drovers of Galloway cattle, and the Suffolk and Norfolk graziers who feed them. The Suffolks are chiefly light duns, thus differing from the Galloways, and are considered a very useful kind of little cattle, particularly for the dairy.



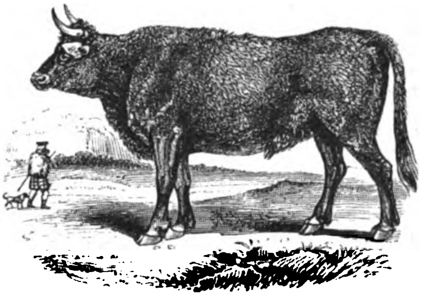
The Ayrshire breed, according to Aiton, is the most improved breed of cattle to be found in the island; not only for the dairy, in which they have no parallel, under similar soil, climate, and relative circumstances; but also in feeding for the shambles. They are, in fact, a breed of cows that have, by crossing, coupling, feeding, and treatment, been improved and brought to a state of perfection, which fits them, above all others yet known, to answer almost in every diversity of situation, where grain and grasses can be raised to feed them, for the purposes of the dairy, or for fattening them for beef. The origin of the Ayrshire breed of cattle is to be found in the indigenous cattle of the county of Ayr, "improved in their size, shapes, and qualities, chiefly by judicious selection, cross-coupling, feeding, and treatment, for a long series of time, and with much judgment and attention, by the industrious inhabitants of the county, and principally by those of the district of Cunningham." The whole dairy breed in the county of Ayr is of mixed white and brown colours. The size of the Ayrshire improved dairy cows varies from twenty to forty stones English, according to the quality and abundance of their food. If cattle are too small for the soil, they will soon rise to the size it can maintain: and the reverse, if they are larger than it is calculated to support. The shapes most approved of are as follows:—"Head small, but rather long and narrow at the muzzle; the eye small, but smart and lively: the horns small, clear, crooked, and their roots at considerable distance from each other; neck long and slender, tapering towards the head, with no loose skin below; shoulders thin; fore-quarters light; hind-quarters large; back straight, broad behind, the joints rather loose and open: carcase deep, and pelvis capacious and wide over the hips, with round fleshy buttocks: tail long and small; legs small and short, with firm joints; udder capacious, broad, and square, stretching forward, and neither fleshy low hung, nor loose; the milk veins large and as their breed is marked with sterility; the latter are animals of the same kind, as their breed is fruitful, and a race of animals is produced, in which the hump belonging to the bison is soon worn away. The differences, therefore, between the cow, the urus, and the bison, are merely accidental. The same caprice in nature that has given horns to some

---

prominent; teats short, all pointing outwards, and at considerable distance from each other; skin thin and loose; hair soft and woolly; the head, bones, horns, and all parts of least value, small: and the general figure compact and well proportioned." The form of the Cunningham Ayrshire cow, according to Robertson, is "very elegant, but must be seen to be well understood. So far as it may be explained in words, it is thus:—The neck is small, the head little, the muzzle taper, the horns short, curved, and bending upwards; the countenance mild: the body straight along the back from shoulder to tail; the limbs slender; the udder shaped like a well turned punch-bowl, and the paps widely set. The head, the neck, the udder are the chief distinguishing points. The colour is generally brown, of many hues, from dark to yellow, intermixed and mottled in many a varied form and proportion with white. Some few have a black ground, without any change in character; but almost none are of one colour only. In a whole hirsel of forty or fifty, there will not two of them be alike in colour; in this respect, exhibiting a diversity not unlike to a bed of tulips, and of as many hues and shades, in an endless variety of beauty. The bulls are generally good tempered, and, like the cows, are also mild in the countenance. The usual produce of butter from these cows is ascertained to be about half their own weight (meaning the four quarters) in a year; but this requires that the pasture be good, and the cow otherwise well kept the whole season over." The produce of such a cow so kept will equal 242 lbs. imperial weight, per annum, of butter, and double that quantity of cheese. The medium produce in butter from Ayrshire milk is about five imperial quarts. The qualities of an Ayrshire dairy-cow "are of great importance. Tameness and docility of temper greatly enhance the value of a milch cow. One that is quiet and contented feeds at ease, does not break over fences, or hurt herself and other cattle, will always yield more milk, and is easier to manage, than those that are of a turbulent disposition. To render them docile, they ought to be gently treated; frequently handled when young, and never struck or frightened. Some degree of hardiness, a sound constitution, and a moderate degree of life and spirits, are qualities to be wished for in a dairy cow, and what those of Ayrshire generally possess. The most valuable quality which a dairy cow can possess is that she yields much milk. A cow in Ayrshire that does not milk well will soon come to the hammer. I have never seen cows any where that, under the same mode of feeding and treatment, would yield so much milk as the dairy breed of that district. Ten Scotch pints per day is no way uncommon. Several cows yield, for some time, twelve pints, and some thirteen or fourteen pints per day. Another quality of the dairy breed of Ayrshire is, that, after they have yielded very large quantities of milk for several years, they are as valuable for beef as the Galloway cow, or any other breed of cows known in Scotland. They fatten as well, and their beef is not inferior to that of any other breed of cattle known in Britain." (*Aiton.*)

The cattle of the Highlands of Scotland are divided into a number of local varieties, some of which differ materially from others, probably owing to a difference in the climate and the quality of the herbage, rather than to their being sprung from races originally distinct, or to any great change effected either by selection or by crossing with other breeds. It is only of late that much attention has been paid to their improvement, in any part of this extensive country; and in the northern and central Highlands the cattle are yet, for the most part in as rude a state, and under management as defective, as they were some centuries ago. These cattle have almost exclusive possession of all that division of Scotland, including the Hebrides, marked off by a line from the Frith of Clyde on the west, to the Murray Frith on the north, and bending towards the east till it approaches in some places very near to the German Ocean. Along the eastern coast, north of the Frith of Forth, the Highland cattle are intermixed with various local breeds, of which they have probably been the basis. There are more or less marked distinctions among the cattle of the different Highland counties; and, in common language, we speak of the Inverness-shire, the Banffshire, &c., cattle, as if they were so many separate breeds; but it is only necessary in this place to notice the two more general varieties, now clearly distinguishable by their form, size, and general properties.

The most valuable of these are the cattle of the western Highlands and Isles, commonly called the *Argyleshire breed*, or the breed of the Isle of Skye, one of the islands attached to the county of Argyle. The cattle of the Hebrides are called *kyloes*, a name which is often applied in the south to all the varieties of the Highland cattle, not as a late writer has imagined, from the district in Ayrshire called Kyle, where very few of them are kept, but from their crossing, in their progress to the south, the *kyloes* or ferries in the mainland and western islands, where these cattle are found in the greatest perfection.



The cattle of Orkney and Zetland are of a most diminutive size; an ox weighing about sixty pounds a quarter, and a cow forty-five pounds. They are of all colours, and their shapes are generally bad: yet they give a quantity of excellent milk; fatten rapidly when put on good pastures; and, in their own district, are considered strong, hardy, and excellent workers, when well trained to the yoke, and so plentifully fed as to enable them to support labour.

Of the *Fifeshire cattle*, Culley observes, "You would at first imagine them a distinct breed, from their upright white horns, being exceedingly light-lyered and thin-thighed; but I am pretty clear that it is only from their being more nearly allied to the kyloes, and consequently less of the coarse kind of short horns in them. Notwithstanding this opinion, the cattle of the north-eastern counties of Scotland require, for every useful purpose, to be mentioned separately from the Highland herds; and as all of them have a general resemblance, it will only be necessary in this place to notice the Fife cattle in particular. There are various traditions about the origin of this variety. It is said to have been much improved by English cows sent by Henry VII. to his daughter, the consort of James IV., who usually resided at the palace of Falkland, in that county; and as there cows, and denied them to others, may also have given the bison a hump, or increased the bulk of the urus; it may have given the one a mane, or denied a sufficiency of hair to the other.

But before we proceed farther, it may be proper to describe these varieties, which have been thus taken for distinct kinds. The urus, or wild bull, is chiefly to be met with in the province of Lithuania; and grows to a size that scarcely any other animal, except the elephant, is found to equal. It is quite black, except a stripe mixed with white, that runs from the neck to the tail, along the top of the back; the horns are short, thick, and strong; the eyes are fierce and fiery; the forehead is adorned with a kind of garland of black curled hair, and some of them are found to have beards of the same; the neck is short and strong; and the skin has an odour of musk. The female, though not so big as the male, exceeds the largest of our bulls in size; nevertheless, her udder and teats are so small, that they can scarcely be perceived.[1] Upon the whole, however, this animal resembles the tame one very exactly, except in some trifling varieties, which his state of wildness, or the richness of the pastures where he is found, may easily have produced.[2]

---

is some resemblance between the cattle of Fife and Cambridgeshire, they are supposed to have been brought originally from the latter county. Others ascribe the origin of the present breed to bulls and cows sent by James VI. (James I. of England), in payment of the money which his obliging neighbours in Fife are said to have advanced for his equipment, when he went to take possession of the English throne.

The prevailing colour of the Fife cattle is black, though sometimes spotted or streaked with white, and some of them are altogether grey. The horns are small, white, generally pretty erect, or at least turned up at the points, bending rather forward, and not wide spread like the Lancashire long-horned breed. The bone is small in proportion to the carcass; the limbs clean, but short; and the skin soft. They are wide between the hook-bones; the ribs narrow, wide set, and having a great curvature. They fatten quickly, and fill up well at all the choice points; are hardy, fleet, and travel well, and are excellent for labour, both at plough and cart. A good cow of this breed gives from eighteen to twenty-four quarts of milk per day, yielding from seven to nine pounds of butter, and from ten to twelve pounds of cheese per week (twenty-four ounces to the pound), for some months after calving.

The *cattle of Aberdeenshire*, the largest of which are said to have been produced by crossing with Fife bulls, have been long highly esteemed in the southern markets. It is observed, that every succeeding generation of them has increased in size for the last thirty years; and that the native breed has doubled its former weight since the introduction of turnips. The colour is commonly black, but there are many of a red and brindled colour. They are thinner in the buttock, in proportion to their weight; and deeper in the belly, in proportion to their circumference, than the west Highlanders, and they yield a much larger quantity of milk. Many of them are brought to the south of Scotland, and kept during winter in the straw-yards, for which they suit better than smaller cattle, as they are not so impatient of confinement. The ordinary weight of middle-sized oxen, at from three to five years old, is from forty to fifty stone; but after being worked for some time, and thoroughly fattened, they have been known to reach double this weight.

Of the *Welsh cattle* there seem to be two distinct kinds. The large sort are of a brown colour, with some white on the rump and shoulders, denoting a cross from the long-horns, though in shape not the least resembling them. They are long in the legs, stand high according to their weight, are thin in the thigh, and rather narrow in the chine; their horns are white and turned upwards; they are light in flesh, and next to the Devons, well formed for the yoke; have very good hoofs, and walk light and nimbly. The other sort are much more valuable; colour black, with very little white; of a good useful form, short in the leg, with round deep bodies; the hide is rather thin, with short hair; they have a likely look, and a good eye; and the bones, though not very small, are neither large nor clumsy; and the cows are considered good milkers.

The *Alderney cattle* are to be met with only about the seats of a few great landholders, where they are kept chiefly for the sake of their milk, which is very rich, though small in quantity. This race is considered, by very competent judges, as too delicate and tender to be propagated to any extent in Britain, at least in its northern parts. Their colour is mostly yellow or light red, with white or mottled faces; they have short crumpled horns, are small in size, and very ill-shaped; yet they are fine-boned in general; and their beef, though high-coloured, is very well flavoured. I have seen, says Culley, some very useful cattle bred from a cross between an Alderney cow and a short-horned bull.

The *Irish cattle*, Culley thinks, are a mixed breed between the long-horns and the Welsh or Scotch, but more inclined to the long-horns, though of less weight than those of England.

[1] This description is chiefly taken from Klein.—*Golds.*

[2] In addition to the domesticated species known by the names of oxen, buffaloes, and yaks, the genus *bos* comprehends several others equally distinct, which have rarely, if ever, been reclaimed from their native wildness. Two of these, the bison and the musk ox, are peculiar to the northern regions of America; one, the Polish aurochs, is now confined to a single European forest; a fourth, the arni, exists only in central Asia; and a fifth, the Cape buffalo, is, as its name imports, a native of the southern extremity of Africa. Thus it appears that in this wide dispersion of the several races, each region has preserved its own peculiar kind in its original independence; while, on the other hand, two at least of the remaining species, the ox and the buffalo, which are no longer to be found in a state of nature, have been industriously propagated, under the auspices of man, throughout almost every part of the surface of the globe. The yak alone, of all the domestic species, remains confined within its primitive limits, in Thibet namely and a part of Tartary, where it is said to be generally cultivated, almost to the exclusion of every other race.

The characters by which the strongly marked group of animals thus associated together are distinguished from the neighbouring tribes, are, like most of those which serve to subdivide the great family of the ruminants, of a very subordinate description. Their horns are common to both sexes, simple in their form, curved outwards at the base and upwards towards the point, and supported internally by bony processes arising from the skull, having cavities within them communicating with the frontal sinuses, which are largely developed. Their muzzle is of large size; the skin along the middle of the neck and chest forms a pendulous dewlap of greater

The bison, which is another variety of the cow kind, differs from the rest, in having a lump between its shoulders. These animals are of various kinds; some very large, others as diminutively little. In general, to regard this animal's fore-parts, he has somewhat the look of a lion, with a long shaggy mane, and a beard under his chin; his head is little, his eyes red and fiery, with a furious look; the forehead is large, and the horns so big, and so far asunder, that three men might often sit between them. On the middle of the back there grows a bunch almost as high as that of a camel, covered with hair, and which is considered as a great delicacy by those that hunt him. There is no pursuing him with safety, except in forests where there are trees large enough to hide the hunters. He is generally taken by pitfalls: the inhabitants of those countries where he is found wild, digging holes in the ground, and covering them over with boughs of trees and grass; then provoking the bison to pursue them, they get on the opposite side of the pit-fall, while the furious animal, running head foremost, falls into the pit prepared for him, and is there quickly overcome and slain.

Besides these real distinctions in the cow kind, there have been many others made, that appear to be in name only. Thus the bonasus, of which naturalists have given us long descriptions, is supposed by Klein and Buffon to be no more than another name for the bison, as the descriptions given of them by the ancients coincide. The bubalus also of the ancients, which some have supposed to belong to the cow kind, Buffon places among the lower class of ruminant quadrupeds, as it most resembles them in size, shape, and the figure of its horns. Of all the varieties, therefore, of the cow kind, there are but two that are really distinct; namely, the cow and the buffalo: these two are separated by nature; they seem to bear an antipathy to each other; they avoid each other, and may be considered as much removed as the horse is from the ass or the zebra. When, therefore, we have described the varieties of the cow kind, we shall pass on to the buffalo, which, being a different animal, requires a separate history.

There is scarcely a part of the world, as was said before, in which the cow is not found in some one of its varieties; either large, like the urus, or humped, as the bison; with straight

---

or less extent; and the general robustness of their make is strikingly contrasted with the lightness and elegance of form of some of the nearly related groups.

In enumerating the species of which this genus is composed we have abstained from mentioning the zebu or Indian ox, simply because we do not consider it entitled to hold that rank in the scale of nature. There can be little doubt that it is merely a variety of the common ox, although it is difficult to ascertain the causes by which the distinctive characters of the two races have been in the process of time gradually produced. But whatever the causes may have been, their effects rapidly disappear by the intermixture of the breeds, and are entirely lost at the end of a few generations. This intermixture and its results would alone furnish a sufficient proof of identity of origin: which consequently scarcely requires the confirmation to be derived from the perfect agreement of their internal structure, and of all the more essential particulars of their external conformation. These, however, are not wanting: not only is their anatomical structure the same, but the form of their heads, which affords the only certain means of distinguishing the actual species of this genus from each other, presents no difference whatever. In both the forehead is flat, or more properly slightly depressed; nearly square in its outline, its height being equal to its breadth; and bounded above by a prominent line, forming an angular protuberance, passing directly across the skull between the bases of the horns. The only circumstances in fact in which the two animals differ consist in the fatty hump on the shoulders of the zebu, and in the somewhat more slender and delicate make of its legs.

Numerous breeds of this humped variety, varying in size from that of a large mastiff-dog to that of a full grown buffalo, are spread, more or less extensively, over the whole of Southern Asia, the islands of the Indian Archipelago and the eastern coast of Africa, from Abyssinia, to the Cape of Good Hope. In all these countries the zebu supplies the place of the ox both as a beast of burthen and as an article of food and domestic economy. In some parts of India it executes the duties of the horse also, being either saddled and ridden, or harnessed in a carriage, and performing in this manner journeys of considerable length with tolerable celerity. Some of the older writers speak of fifty or sixty miles a day as its usual rate of travelling; but the more moderate computation of recent authors does not exceed from twenty to thirty. Its beef is considered by no means despicable, although far from equalling that of the European ox. The hump, which is chiefly composed of fat, is reckoned the most delicate part.

As might naturally be expected from its perfect domestication and wide diffusion, the zebu is subject to as great a variety of colours as those which affect the European race. Its most common hue is a light ashy gray, passing into a cream colour or milk-white; but it is not unfrequently marked with various shades of red or brown, and occasionally it becomes perfectly black. Its hump is sometimes elevated in a remarkable degree, and usually retains its upright position; but sometimes it becomes half pendulous and hangs partly over towards one side. Instances are cited in which it had attained the enormous weight of fifty pounds. A distinct breed is spoken of as common in Surat, which is furnished with a second hump. Among the other breeds there are some which are entirely destitute of horns, and others which have only the semblance of them, the external covering being unsupported by bony processes, and being consequently flexible and pendulous.

horns, or bending, inverted backwards, or turning sideways to the cheek, like those of the ram; and, in many countries, they are found without any horns whatsoever.[1] But, to be more particular, beginning at the north, the few kine which subsist in Iceland, are without horns, although of the same race originally with ours. The size of these is rather relative to the good-

---

[1] Until of late years, it was very generally considered that the domestic ox, the wild bull (*urus*) of Europe and Asia, and the American bison were only varieties of the same species, or, in other words, that the domestic ox was the urus altered by civilization, and that the bison was the urus altered by climate. This was the opinion of Buffon, Pallas, and other distinguished naturalists. The identity of the urus and the bison being assumed, it became a question of somewhat difficult solution how these animals migrated from the old to the new world. Many ingenious theories were framed to meet the circumstances, but the necessity for these speculations has been superseded by the discovery made by Cuvier, that the bison of America is really a species distinct from the urus; and he has indicated the very important differences by which the distinction is established.

We may consider the bison as characterized by fifteen pair of ribs, (the wild bull has only fourteen,) and by the immense disproportion between its fore and hind quarters. The latter distinction is partly occasioned by the great hump or projection over its shoulders. This hump is oblong, diminishing in height as it extends backward, and giving a considerable obliquity to the outline of the back. The hair over the head, neck, and fore part of the body is long and shaggy, forming a beard beneath the lower jaw, and descending below the knee in a tuft. The hair on the summit of the head rises in a dense mass nearly to the tip of the horns, and directly on the front is curled and strongly matted. The ponderous head, rendered terrific by its thick, shaggy hair and streaming beard, is supported upon a massive neck and shoulders, the apparent strength of which is more imposing from the augmentation produced by the hump and the long fall of hair by which the anterior parts of the body are covered. This woolly hair is remarkable not less for its fineness than its length. The difference between the winter and the summer coat of the bison consists rather in the length than in the other qualities of the hair. In summer, from the shoulders backward, the surface is covered with very short fine hair, smooth and soft as velvet. Except the long hair on the fore parts, which is to a certain extent of a rust colour or yellowish tinge, the colour is a uniform dun. Varieties of colour are so rare among the species, that the hunters and Indians always regard any apparent difference with great surprise. The fleece or hair of a full-grown bison, when separated from the skin, is usually found to weigh about eight pounds, according to Charlevoix. The horns are shorter than in any other species, nearly straight, sharp-pointed, exceedingly strong, and planted widely asunder at the base, as in the common bull. The tail is almost a foot long, and terminates in a tuft, which is black in the males and red in the females. The eyes are large and fierce; the limbs are of great strength; and the appearance of the animal is altogether exceedingly grim, savage, and formidable. According to Hearne, the size of the bison is, on the average, less than that of the urus, but exceeds that of every other species of the ox. It has been known to weigh 1600 and even 2400 lbs.; and the strongest men are said to be unable, singly, to lift one of the skins from the ground. The female is much smaller than the male; she has not so much of the long hair in front, and her horns are not so large nor so much covered by the hair. The males and females associate from the end of July to the beginning of September; after which the females separate from the males, and remain in distinct herds. They calve in April. The calves seldom leave the mother until they are a year old, and sometimes the females are seen followed by the young of three seasons.

The bisons generally seek their food in the morning and evening, and retire during the heat of the day to marshy places. They rarely resort to the woods, preferring the open prairies where the herbage is long and thick. They also associate in vast troops led by the fiercest and most powerful of the bulls. In both these respects their habits differ from those of the urus, which leads a solitary life in the deepest gloom of the forest. The herds of bisons are frequently of astonishing density and extent. Mr James says, that in one place at least ten thousand of these fine animals burst upon the sight in an instant. He adds, "In the morning we again sought the living picture, but upon all the plain, which last evening was teeming with noble animals, not one remained." Notwithstanding their terrible aspect, the bison is not an enemy of man, and will never attack him unless when wounded or at bay. During the season in which the males and females associate, and when the passions of the former are in full activity, the noise of the roaring of these immense herds, resemble thunder, and the males often fight most desperate battles with each other.

While feeding, they are often scattered over a vast surface; but when they move forward in mass, they form a dense impenetrable column, which once fairly in motion is scarcely to be turned. They swim large rivers nearly in the same order in which they traverse the plains; and when flying from pursuit, it is in vain for those in front to make a sudden halt, as the rearward throng dash madly forward, and force their leaders on. The Indians sometimes profit by this habit. They lure a herd to the vicinity of a precipice, and setting the whole in rapid motion, they terrify them by shouts and other artifices to rush on to their inevitable destruction. The chase of the bisons, indeed, constitutes a favourite diversion of the Indians, numerous tribes of whom may be said to be almost entirely dependent on these animals for all their necessaries of life. They are killed either by shooting them, or by gradually driving them into a small space by setting fire to the grass around the place where the herd is feeding. They are much terrified by fire, and crowd together to avoid it; and they are then killed by bands of Indians without any personal hazard. It is said that, on such occasions, 1500 or 2000 have sometimes been killed at a time.

The flesh of the bison is coarser grained than that of the domestic ox, but is considered by hunters and travellers as superior in tenderness and flavour. That of the males is poor and the flesh disagreeable in the months of August and September. They are much more easily approached and killed than the females, not being so vigilant, but the females are preferred on account of the greater fineness of their skins and more tender flesh. The hump of the bison is highly celebrated for its richness and delicacy, and is said, when properly cooked, to resemble marrow. The Indian method of preparing this delicacy is as follows:—The hump is cut off the shoulders, and a piece of skin is sewed over the severed part. The hair is then singed off, and the whole is ready for the oven. This is a hole in the earth, in and over which a fire has been burned; and into this heated receptacle the hump is conveyed, and covered, about a foot deep, with earth and ashes. A strong fire is again laid over the spot, and, supposing these preparations to have begun on the ness of the pasture, than the warmth or coldness of the climate. The Dutch frequently bring great quantities of lean cattle from Denmark, which they fatten on their own rich grounds. These are in general of a larger size than their own natural breed; and they fatten very easily. The cattle of the Ukraine, where the pasture is excellent, become very fat, and are considered as one of the largest breeds of Europe. In Switzerland, where the mountains are covered with rich nourishing herbage, which is entirely reserved for their kine, these animals grow to a very large size. On the contrary, in France, where they get no other grass but what is thought unfit for horses, they dwindle and grow lean. In some parts of Spain the cow grows to a good size: those wild bulls, however, which they pride themselves so much in combating, are a very mean despicable little animal, and somewhat shaped like one of our cows, with nothing of that peculiar sternness of aspect for which our bulls are remarkable. In Barbary, and the provinces of Africa, where the ground is dry, and the pasturage short, the cows are of a very small breed, and give milk in proportion. On the contrary, in Ethiopia, they are of a prodigious bigness. The same holds in Persia and Tartary; where, in some places, they are very small, and, in others, of an amazing stature. It is thus, in almost every part of the world, this animal is found to correspond in size to the quantity of its provision.

If we examine the form of these animals, as they are found tame, in different regions, we shall find, that the breed of the urus, or those without a hump, chiefly occupies the cold and the temperate zones; and it is not so much dispersed towards the south. On the contrary, the breed of the bison, or the animal with a hump, is found in all the southern parts of the world; throughout the vast continent of India; throughout Africa, from mount Atlas to the Cape of Good Hope. In all these countries, the bison seems chiefly to prevail; where they are found to have a smooth soft hair, are very nimble of foot, and in some measure supply the want of horses. The bison breed is also more expert and docile than ours; many of them, when they carry burdens, bend their knees to take them up, or set them down: they are treated, therefore, by

---

evening of one day, the hump will be ready for eating by the next day at noon. The tongue and marrow-bones are regarded by the connoisseurs in bison's flesh to be the parts next in excellence to the hump. The skins of the bisons are of a loose and spongy texture; but when dressed in the Indian manner with the hair on, they make admirable defences against the cold, and may be used for blankets. They are called buffalo robes; the term buffalo being generally, but inaccurately, applied to the bison. The wool of the bison has been manufactured into hats, and has also been employed in making coarse cloth of a very strong and durable texture.

Vast multitudes of bisons are slaughtered every year; and it is to be deeply regretted that the white hunters and traders are in the habit of destroying these valuable beasts in the most wanton and unnecessary manner. It is common for such persons to shoot bisons, even when they have abundance of food, for the sake of the tongue or hump alone; or even for no other reason than because they come near enough to present a fair aim. It is, therefore, not surprising that, from all these causes of diminution, the bisons become less numerous every year, and remove farther and farther from the haunts of men. The numbers of this species still existing are surprisingly great, when we consider the immense destruction of them since European weapons have been employed against them. They were once extensively diffused over what is now the territory of the United States, except that part lying east of the Hudson's River and the lake Champlain, and narrow strips of coast on the Atlantic and Pacific. At the present time their range is very different; they are no longer found except in the remote unsettled regions of the north and West, being rarely seen east of the Mississippi, or south of the St Lawrence. West of Lake Winnipeg they are found as far north as 62°; west of the Rocky Mountains it is probable they do not extend north of the Columbia river. American authorities assure us that the time cannot be far distant when the bisons, like the Indian tribes which hover near them, will have passed away.

On the old continent, bisons may be now looked upon as residing only in the forests of Southern Russia, in Asia, the Carpathian and Caucasian mountain forests, and the Kobi Desert. They prefer high wooded localities to the plain or low lands, live in small troops, and have a groaning voice. The Gaw-Kottah of the Persians is probably this animal.

The Gaur.—This is a species of bison, which, from all accounts, appears to be among the largest now living; and although in Indian phraseology the word buffalo has been used, no doubt can exist respecting its affinity to the bison; indeed the gaur may be no other than the true bison, though from certain testimonies we are inclined to regard it as an intermediate species. The head of the gaur exhibits all the characteristics of the domestic ox, but the forehead is more arched and raised; the horns strong and rough, are not bent back as in the buffalo; the eyes are smaller than the ox; the muscles of the legs and thighs very prominent and strong. But the most remarkable character of the gaur, that which should distinguish it from all other ruminants, consists in a series of spinous processes along the back, beginning at the last vertebra of the neck, shortening gradually till they are lost half way down the spine; the foremost are at least six inches higher than the ridge of the back. These gaurs live in families of ten or twenty, graze on the meadows, and feed on leaves and buds of trees. Buffaloes fear their presence and never invade their localities.

The Gagal is another of the existing species, which is nearly the size and shape of an English bull, with a dull and heavy appearance; but at the same time, of a form equal in strength and activity with the wild buffalo. It would be tedious to recite its peculiarities; suffice it, in the place of the hump, the gagal has a sharp ridge which commences on the hinder part of the neck, slopes gradually up till it comes over the shoulder joints, then runs horizontally almost a third part of the back, where it terminates with a very sudden slope. The people inhabiting the hills to the eastward of Chitagong have herds of the gagal in a domestic state.

the natives of those countries, with a degree of tenderness and care equal to their utility; and the respect for them in India has degenerated even into blind adoration. But it is among the Hottentots where these animals are chiefly esteemed, as being more than commonly serviceable. They are their fellow-domestics, the companions of their pleasures and fatigues; the cow is at once the Hottentot's protector and servant, assists him in attending his flocks, and guarding them against every invader: while the sheep are grazing, the faithful backely, as this kind of cow is called, stands or grazes beside them; still, however, attentive to the looks of his master, the backely flies round the field, herds in the sheep that are straying, obliges them to keep within proper limits, and shows no mercy to robbers, or even strangers, who attempt to plunder. But it is not the plunderers of the flock alone, but even the enemies of the nation, that these backelies are taught to combat. Every army of Hottentots is furnished with a proper herd of these, which are let loose against the enemy, when the occasion is most convenient. Being thus sent forward, they overturn all before them; they strike every opposer down with their horns, and trample upon them with their feet; and thus often procure their masters an easy victory, even before they have attempted to strike a blow. An animal so serviceable, it may be supposed, is not without its reward. The backely lives in the same cottage with its master, and, by long habit, gains an affection for him; and in proportion as the man approaches to the brute, so the brute seems to attain even to some share of human sagacity. The Hottentot and his backely thus mutually assist each other; and when the latter happens to die, a new one is chosen to succeed him, by a council of the old men of the village. The new backely is then joined with one of the veterans of his own kind, from whom he learns his art, becomes social and diligent, and is taken for life into human friendship and protection.

The bisons, or cows with a hump, are found to differ very much from each other in the several parts of the world where they are found.[1] The wild ones of this kind, as with us, are much larger than the tame. Some have horns, and some are without any; some have them depressed, and some raised in such a manner that they are used as weapons of annoyance or defence; some are extremely large, and others among them, such as the zebu, or Barbary cow, are very small. They are all, however, equally docile and gentle when tamed; and, in general, furnished with a fine lustrous soft hair, more beautiful than that of our own breed; their hump is also of different sizes, in some weighing from forty to fifty pounds, in others less; it is not, however, to be considered as a part necessarily belonging to the animal; and probably it might be cut away without much injury: it resembles a gristly fat; and, as I am assured, cuts and tastes somewhat like a dressed udder. The bisons of Malabar, Abyssinia, and Madagascar, are of the great kind, as the pastures there are plentiful. Those of Arabia Petræa, and most parts of Africa, are small, and of the zebu or little kind. In America, especially towards the north, the bison is well known. The American bison, however, is found to be rather less than that of the ancient continent; its hair is longer and thicker, its beard more remarkable, and its hide more lustrous and soft. There are many of them brought up tame in Carolina; however, their wild dispositions still seem to continue, for they break through all fences to get into the corn-fields, and lead the whole tame herd after them, wherever they penetrate. They breed also with the tame kinds originally brought over from Europe; and thus produce a race peculiar to that country.

From all this it appears,[2] that naturalists have given various names to animals in reality the same, and only differing in some few accidental circumstances. The wild cow and the tame, the animal belonging to Europe, and that of Asia, Africa, and America, the bonasus, and the urus, the bison and the zebu, are all one and the same, propagate among each other, and, in the course of a few generations, the hump wears away, and scarcely any vestiges of savage fierceness are found to remain. Of all animals, therefore, except man alone, the cow seems most extensively propagated. Its nature seems equally capable of the rigours of heat and cold. It is an inhabitant as well of the frozen fields of Iceland, as the burning deserts of Libya. It seems an ancient inmate in every climate, domestic and tame in those countries which have been civilized, savage and wild in the countries which are less peopled, but capable of being made useful in all; able to defend itself in a state of nature against the most powerful enemy of the forest; and only subordinate to man, whose force it has experienced, and whose aid it at last seems to require. However wild the calves are, which are taken from the dam in a savage state, either in

---

[1] Among the bisons are found indications of an ancient and colossal species existing at one time in Europe and northern Asia, and even in America, attested by the repeated discovery of enormous skulls in the diluvian strata of the earth, on the vegetable mould, and even beneath them, among the remains of the mastodon and rhinoceros.

[2] Buffon, vol. xxiii. p. 130.

Africa or Asia, they soon become humble, patient, and familiar; and man may be considered in those countries, as almost helpless without their assistance. Other animals preserve their nature or their form with inflexible perseverance; but these, in every respect, suit themselves to the appetites and conveniences of mankind; and as their shapes are found to alter, so also does their nature; in no animal is there seen a greater variety of kinds, and in none a more humble and pliant disposition.[1]

THE BUFFALO.

If we should compare the shape of our common cow with that of the bison, the difference will appear very great. The shaggy mane of the latter, the beard, the curled forehead, the inverted horns, the broad breast, and the narrow hinder parts, give it the appearance rather of a lion than a cow; and fit it more for a state of war with mankind than a state of servitude. Yet notwithstanding these appearances, both animals are found to be the same; or at least so nearly allied that they breed among each other, and propagate a race that continues the kind.[2]

On the other hand, if we compare the buffalo with our common cow, no two animals can be more nearly alike, either in their form or their nature; both equally submissive to the yoke, both often living under the same roof, and employed in the same domestic services; the make and the turn of their bodies so much alike, that it requires a close attention to distinguish them: and yet after all this, no two animals can be more distinct, or seem to have greater antipathies to each other. Were

---

[1] There is a musk-bull which inhabits the interior parts of North America, on the west side of Hudson's Bay. It is in size equal to a Guernsey cow; the hair is brownish-black, occasionally marked with large white blots; it grows to a very great length, and is composed of a long and soft down, intermixed with straight hairs; the summit of the head of the male is covered by the horns, which form a kind of scalp, in the female it is covered with hair: the legs are generally white, and the hair spreads forward under the heels, so as to cover the greater part of the frog. These animals live in herds of thirty or forty; the bulls are few in proportion to the cows, caused, as it appears, by the mortal conflicts among them for the possession of the females; for it is observed that dead males are often found, and that in the rutting season the bulls are so jealous, that they run bellowing at every animal, even ravens, to drive them off. They rut in August, and the females calve about the end of May, never bearing more than one; they prefer mountains and barren grounds, to wooded countries, climb rocks with agility and secure footing; they feed principally on grass, when in season, but mostly on mosses, the tops of pine shoots, and willows. The flesh is flavoured like that of the elk; the fat clear white with a tint of azure; but the calves and heifers are the best for the table, the meat of old bulls being so impregnated with a musky smell, as to be very disagreeable food. The genitals of the male are always lubricated with a musky unctuous secretion, which is so powerful as to retain its smell for several years; the dung is in small round kobs like that of the varying hare: several thousand weight of the flesh are usually brought frozen by the Indians for winter store, to Prince of Wales Fort. Captain Parry met this species as far north as Melville Island, with the first appearance of the spring; each carcass furnishing him with from three hundred to three hundred and fifty pounds of beef. It descends as far south and west as the Province of Guivira according to Lopez Gomara, where the Spaniards found sheep as large as a horse, with long hair, short tails, and enormous horns. Messrs Hearne, Dobbs, and Graham, have supplied the fullest information relative to this animal, which was first described by Mr Pennant, though noticed long before by Mr Jeremie, a French officer, who was stationed in Canada, during the succession war.

[2] Buffaloes in general are animals of a large stature, resembling a bull, low in proportion to their bulk, and supported by strong and solid limbs. The head is large, the forehead, though narrow, is remarkably strong and convex: the chaffron straight, flat, prolonged, and terminated by a broad muzzle; the horns being flat or bending laterally, with a certain direction to the rear, and therefore not very applicable in goring; the ears are rather large, never erect, funnel-shaped; the eyes large: they have no bunch on the back, but a small dewlap on the breast. The females bear an udder with four mammæ, two of which are sometimes not developed: the tail is long and slender; the back rather straight; the hide black, more or less covered with hair of an ashy or blackish colour; sometimes it is brown or white. They avoid hills, preferring coarse plants of the forest and such as grow in swampy regions, to those of open plains; they love to wallow and lie for hours sunk deep in water; they swim well, or rather float on the surface, and consequently pass the broadest rivers without hesitation; their gait is heavy, and unwieldy, and run almost always with the nose horizontal, being principally guided by their sense of smelling; but this attitude prevents their seeing beneath them and conceals their horns. In their combats, they usually strike or butt with the forehead, endeavour to lift the opponent on their horns, and when thrown to crush him with their knees; they trample on the body, and their vindictive fury is so lasting, that they will return again and again to glut their vengeance upon the same inanimate corpse; they herd together in small flocks, or live in pairs, but are never strictly gregarious in a wild state, they have a tenacious memory, and they low in a deep tone. The females bear calves two years following, but remain sterile during the third; gestation is said to last twelve months, but it appears not to exceed ten; they propagate at four and a half years old, and discontinue after twelve. Parturition (in Europe) takes place in the spring, and never exceeds one calf. Dr Pallas asserts that they breed with domestic cattle, but that the produce usually dies; their life may extend to twenty-five years.

Although in a domestic state they are not remarkable for docility or attachment to their keepers, yet a feeling of this kind, mixed no doubt with instinctive antipathy, is exemplified in an anecdote related by Mr D. Johnson. "Two biparies, or carriers of grain and merchandise on the backs of bullocks, were driving a loaded string of these animals from Palamow to Chitrah: when they were come within a few miles of the latter place, a tiger seized on the man in the rear, which was seen by a *guallah* (herdsman,) as he was watching his buffaloes grazing: he boldly ran up to the man's assistance, and cut the tiger very severely with the sword; upon which he dropped the biparie, and seized the herdsman. The buffaloes observing it, attacked the tiger, and rescued the herdsman; they tossed him about from one to the other, and, there but one of each kind remaining, it is probable the race of both would shortly be extinct. However, such is the fixed aversion formed between these creatures, that the cow refuses to breed with the buffalo, which it nearly resembles; while it is known to propagate with the bison, to which it has, in point of form, but a very distant similitude.

The buffalo is, upon the whole, by no

---

to the best of my recollection, killed him. Both the wounded men were brought to me: the biparie recovered, and the herdsman died." This anecdote reveals, if not attachment, great antipathy and courage; and it is well known that neither the tiger nor the lion are inclined to prey upon the buffalo, whose vengeance is probably kept alive by occasional depredations on their young, and Indian herdsmen do not scruple to pass the night in the most dangerous jungle, seated upon the back of some one favourite animal.

Their extreme hostility to red colours is often remarked in India; the same antipathy is observed at the Cape and in Europe. A general officer, now living, relates, that while a young man he was employed in surveying in Hungary, and happening to use a small plane table, the back of which was covered with red morocco: as he walked from one station to another, he sometimes carried it with the paper against his breast, and the crimson colour in front. On a sudden, he perceived at a considerable distance a herd of grazing buffaloes throw out signs of defiance, and come down in full gallop towards him with their tails up, and evincing the most tumultuous frenzy. Not suspecting the cause, he paused and dropped his hand, when the whole troop stopped and looked about, as if at a loss; he went on, and unconsciously raising the table again, brought the red colour in sight. They set off a second time towards him, but guessing the cause, he turned the obnoxious colour towards his body, and was suffered to proceed unmolested.

The *Cape Buffalo* (*Caffer.*) This species is designated among the Hottentots by the name of Qu'araho. It is distinguished by dark and rugous horns spreading horizontally over the summit of the head in the shape of a scalp, with the beams bent down laterally, and the points turned up. They are from eight to ten inches broad at the base, and divided only by a slight groove, dark coloured, extremely ponderous, cellular near the root, and five feet long, measured from tip to tip along the curves. The incisor teeth are almost always loose in the gums of the adult animal, whose height is about five feet six inches at the shoulder, and the length from nose to tail about nine feet; the legs are short and strongly knit; the dewlap is rather considerable; the ears large, hanging open; on each side of the chin and nether jaw, there is a beard of stiff hairs; the hide extremely thick, hard and black, and almost naked in old animals. In younger beasts, a scattered brown hair covers the neck, back, and belly; and in the young heifer, the colour is brown-black, the hair more abundant, and a sort of standing mane four inches long, spreads from behind the horns, along the neck, down the spine to the tail, darker than the rest of the hair, almost black. At that age, the horns are only six inches long, thirteen inches distant from tip to tip, pale in colour, originating at the side of the frontal crest and rising obliquely upwards, with some slight indication of wrinkles. The forehead and nuccha are covered with loose black hair, as also the throat, dewlap, and top of the tail, the shin bones and pasterns furnished with curling woolly dark hair. The head is one foot long, and the length of the animal, from nose to tail, five feet seven inches; the tail one foot. At that age, there is so great a dissimilarity from the adult, as to give it the appearance of a different species, for which, indeed, it was taken in the specimen of Mr Burchell, had not a note within the skin established the species. There is some doubt whether Pliny alludes to this species in his description of the fierce African wild oxen which were caught in pit-falls: the Araho is truly a terrible and ferocious beast, possessed of a tremendous bellowing voice, and moving with considerable swiftness, but so ponderous as to be disinclined to ascend; its scent is keen, but the breadth of the horns impede its sight. This species of buffalo lives in families or small herds in the brushwood and open forests of Caffraria, occasionally uniting in droves upon the plain. Old bulls are often met alone, but though these are, if possible, still fiercer than the younger, they are less swift or inclined to exertion. In the woods, they make paths for themselves, where it is extremely dangerous to fall in with them. Professor Thunberg gives an appalling account of the destruction of two horses by one of these animals, the riders providentially escaping by climbing trees, and the professor himself driven to the same expedient, though his horse remained unhurt, owing to the buffalo turning into the wood. Sparmann, who first fully described this species, is no less animated in the dangerous hunting exploits he witnessed. They are excited to madness by the sight of red colour, and swim with great force. The hide is made into shields, cut into whips and traces, and is so hard that a musket ball will scarcely penetrate into it, unless the lead be mixed with tin. If this animal could be rendered tractable, it would make the most powerful in agriculture existing. Since the increase of the settlements about the Cape of Good Hope, the buffalo is become more scarce in the colony, but they spread along the eastern side of Africa to an unknown distance in the interior.

The *Pagasse.* (*B. Pegasus.*) The names of Pacasse of Gallini and Carli, Empaguessa of Merolla, Empacasse of Lopes and Marmol, indicate an animal, presumed to be a species of buffalo, but not described with sufficient precision to be admitted into the catalogues of nomenclators. The word is evidently of great antiquity and extent, as may be gathered from Pliny, although at present banished from the regions where the Arabic has usurped the ancient language, and confined to the regions of Angola and Congo, where it is coupled with the generic name *Em* or *En*, denoting a Bovine animal. Thus Engamba a cow, Empalanga, another large ruminant which is conjectured to be the Tackhaitze of Daniell; and Em-pacasse. Pliny relates that Æthiopia produces winged horses, armed with horns named Pegasi. Fathers Gallini and Carli observe, that, "On the road to Loando in the kingdom of Congo, they saw two pacasses, which are animals very similar to buffaloes, roaring like lions; the male and female being always together. They are white with rufous and black spots; with ears half a yard in length, and the horns always straight. When they see human beings they do not flee, nor do they harm, but stand and look on." Lopes describes them as somewhat less than an ox, but similar in head and neck. Dapper reports them to be buffaloes of a reddish colour, with long horns. These testimonies are very vague, but still indicate one and the same animal, means so beautiful a creature as the cow; his figure is more clumsy and awkward; his air is wilder; and he carries his head lower, and nearer the ground; his limbs are less fleshy, and his tail more naked of hair; his body is shorter and thicker than that of the cow kind; his legs are higher; his head smaller; his horns not so round, black, and compressed,

---

partially misrepresented. To these accounts might be added the notice of Captain Lyons respecting the Wadan, "a fierce buffalo, the size of an ass, having large tufts of hair on the shoulders, and very long heavy horns."

The *Arnee (B. Arni.)* India and China are the native regions of another group of true buffaloes, both wild and tame, which Baron Cuvier's investigations refer to one species, divided into mere varieties. It appears that the wild buffalo in the central districts of Bengal, is commonly named Arnee or Arnaa, and distinguished by the lunate form of the horns and black colour; while the second sort, usually but not always domestic, is known by the appellation of *bhain* or byne. Of this sort, the horns are much shorter, bent back towards the neck with the points turned upwards: thus constructed, their arms are but indifferent instruments of attack, and serve only to lift, while in the former they are invariably used for goring. But neither of these are the gigantic or taurelephant arnee, which appears to be a rare species, only found single or in small families, in the upper eastern provinces and forests at the foot of Himalaya, though formerly met in the Ramghur districts. It is probably the same which the Mugs and Burmas name Phang, and consider next to the tiger the most dangerous and fiercest animals of their forests. A party of officers of the British cavalry, stationed in the north of Bengal, went on a three months' hunting expedition to the eastward, and destroyed in that time forty-two tigers, but only one arnee, though numerous wild buffaloes became their quarry. When the head of this specimen rested perpendicular on the ground, it required the outstretched arms of a man to hold the points of the horns. These are described as angular, with the broadest side to the rear, the two others anterior and inferior, wrinkled, brownish, standing outwards, not bent back, straight for near two-thirds of their length, then curving inwards with the tips rather back; the face is nearly straight, and the breadth of the forehead is carried down with little diminution to the foremost grinder. The best figure, we are assured, is in Captain Williamson's *Oriental Field Sports*. Captain Williamson evidently speaks of the true arnee in the anecdote, where one of these animals pursued a sportsman to his elephant, and ran its horns under his belly to lift him up. This buffalo was killed, and was upwards of six feet high at the shoulder, nearly three feet in breadth at the breast, and the horns five feet and a half long. The other or common arnee is also a very large animal, though nearly a foot lower at the shoulders than that last mentioned. It is not much less in weight; the head is smaller, the body longer, the tail reaching to near the heels, and the hide more scantily covered with hair. These are much more common, live gregariously in woody swamps or plains, occasionally floating in whole droves down the Ganges, seemingly asleep, until the current lands them on some island, or on the bank: boats are sometimes endangered by sailing in among them unawares. They are said to plunge under water, and raise aquatic plants with their horns to the surface, where they feed on them, while drifting with the stream. An animal of this kind drifted down to near Shaugur Island, in 1790, and was shot by the crew of the Hawkesbury Indiaman, towed alongside, and hoisted in; the meat weighed three hundred and sixty pounds per quarter, exclusive of the head, legs, hide, and entrails, and the whole could, therefore, be scarcely less than two thousand pounds, though the ship's butcher pronounced it not above two years old. A herd of these animals was observed by a column of troops, some years ago, on the march to Patna, by the inland road. On discovering the red dresses of the soldiers, they threw out their usual signals of hostility, and galloped off; then suddenly wheeling round, came in a body, as if they intended to charge, and their horns overtopping the heads, rendered it doubtful whether they were not mounted by some hostile force; part of the column, therefore, halted and formed, and the animals suddenly struck by the glittering of the arms, stopped, turned tumultuously round, and dashed into cover. These anecdotes show the scepticism of some continental naturalists, respecting the existence of wild buffaloes in India, to be quite misplaced. Formerly, this race was occasionally reduced to a precarious domesticity, by order, and for the amusement of, the native princes; but now they use the largest of the domestic breeds: these are mounted by their keepers and brought into the arena to engage in battle with the tiger, who is almost invariably defeated. The race of the common arnee is also, it would appear, domesticated in the eastern states: a white variety is found in Tinean, and other islands of the Indian Archipelago. On the coast of Cochin China, and the Malayan peninsula, this race appears to predominate: they are of very great bulk, with the horns, when seen in front, forming a true crescent; their skulls are the usual arnees of European museums. Although the skin of the white variety be rosy, the muzzle and edge of the lips are jet black, the eyes are large and dark, the snout longer and narrower than in the black-skinned buffalo, and their height at the shoulder is not five feet, owing to the legs being short. Those of Siam, both wild and domesticated, are ashy grey, larger than an ox, the muzzle much prolonged, and the horns very long, forming a crescent above the head. This variety has a shrill weak voice, and the domesticated are more easily managed by children than by grown men.

The *Domestic Buffalo. (B. Babelus.)* Whether or not the arnee of Bengal be the stock from which the domestic buffalo is descended, certain it is that the species now under consideration, is still found in a wild state, as well as domesticated, and that in all countries, sufficiently uninhabited and affording the requisite conditions, the black-skinned domestic animal will soon supply a wild breed. This occurs whenever local circumstances are favourable, even in the kingdom of Naples, and we might draw an inference from this fact alone, that the species with crescent horns, are distinct from the present, although both have breeds which have received the yoke of man; nor if it were proved that a prolific intermediate race exist, produced by the intermixture of both, would it fully determine that both form only one original species. What forms a species, and what a variety, is, as yet, far from well understood. The Bhain of India may be regarded as the true stock of the domestic buffaloes of southern and western Asia, north Africa, and eastern Europe. Little doubt can be raised, that in India that animal was first subdued, perhaps, by means of the intelligence and powers of the elephant, who alone could compel it to subjection; from thence, commerce or remote military expeditions seem to have introduced it into Tartary and eastern Persia, till by either of these means the domestic buffalo was found on the shores of the Caspian. Here they resided at the time of the Macedonian invasion, though the Tartars seem to have used their busan as beasts of burden, at least as early, and about that period, or soon after, to have led them to the banks of the Terreck. They were found by the Mahomedan with a bunch of curled hair hanging down between them; his skin is also harder and thicker, more black, and less furnished with hair; his flesh, which is hard and blackish, is not only disagreeable to the taste but likewise to the smell. The milk of the female is by no means so good as that of the cow; it is however produced in great abundance. In the warm countries almost all their cheese is made of the milk of the buffalo; and they supply butter also in large quantities. The veal of the young buffalo is not better eating than the beef of the old. The hide of this animal seems to be the most valuable thing he furnishes. The leather made of it is well known for its thickness, softness, and impenetrability. As these animals are, in general, larger and stronger than the cow, they are usefully employed in agriculture. They are used in drawing burdens, and sometimes in carrying them; being guided by a ring, which is thrust through their nose. Two buffaloes yoked in a waggon, are said to draw more than four strong horses; as their heads and necks are naturally bent downward, they are thus better fitted for the draught, and the whole weight of their bodies is applied to the carriage that is to be drawn forward.

From the size and bulk of the buffalo, we may be easily led to conclude that he is a native of the warmer climates. The largest quadrupeds are generally found in the torrid zone; and the buffalo is inferior in point of size only to the elephant, the rhinoceros, or the hippopotamus. The camelopard or the camel may indeed be taller, but they are neither so long, nor near so corpulent. Accordingly, we find this animal wild in many parts of India; and tamed also wherever the natives have occasion for his services. The wild buffaloes are very dangerous animals, and are often found to gore travellers to death, and then trample them with their feet, until they have entirely mangled the whole body; however in the woods they are not so much to be feared as in the plains, because in the violence of their pursuit their large horns are apt to be entangled in the branches of the trees, which gives those who have been surprised by them time to escape the danger. There is scarcely any other method of avoiding their pursuit; they run with great swiftness; they overturn a tree of moderate growth; and are such swimmers, as to cross the largest rivers without any difficulty. In this manner, like all other large animals of the torrid zone, they are very fond of the water; and in the midst of their pursuit, often plunge in, in order to cool themselves. The Negroes of Guinea, and the Indians of Malabar, where buffaloes are in great abundance, take great delight in hunting and destroying them: however they never attempt to face the buffalo openly; but generally climbing up the tree, shoot at him from thence, and do not come down till they find they have effectually despatched him. When they are tamed, no animal can be more patient or humble; and though by no means so docile as the cow kind, yet they go through domestic drudgeries with more strength and perseverance.

Although these animals be chiefly found in the torrid zone, yet they are bred in several parts of Europe, particularly in Italy, where they make the food and the riches of the poor. The female produces but one at a time, in the

---

Arabs in Persia, and during their wars brought westward into Syria, and Egypt. Baron Cuvier, with his accustomed research, proves the pilgrims and writers concerning Palestine to have noticed them by the name of Buflus, early in the eight century. The stature of the buffalo varies according to the circumstances of food and climate. The Hungarian and Italian are about eight feet and a half long, by five feet at the shoulders; the horns are directed sideways, compressed, with a ridge in front, reclining towards the neck, and the tips turned up, placed at a great distance from each other, with a convex forehead between them; the mammæ of the female placed in a transverse line; the hair scattered, coarse, and black, and the tail long, terminated by a tuft; the hide is of a purplish black, in India almost naked, in Egypt, sometimes totally without hair, and in the Indian Archipelago the interior half is occasionally covered with long hair, and the posterior naked; it varies also to rufous, and white occurs in some breeds. It is an animal at all times of very doubtful docility, with a sombre malignant eye, active, daring, swift, and persevering when excited; dull, slow, wallowing in his ordinary state: naturally preferring flats and swampy soil; possessed of great strength for burden and for the plough, two being equal in power to four horses: but furnishing little, and indifferent milk, and worse flesh: the hide and horns are alone valuable. In India, however they furnish more milk from which a kind of liquid butter is made, well known by the name of *ghee*. The domestic breed in Bengal, is not more than four feet and a half high, and used to labour; but for burden, care must be taken that the goods they carry do not suffer from wet, their propensity to lie down in water being invincible; wood and bricks are, therefore, the most common load. The largest of the wild breed, are used by the native princes to supply the place of Arnees, and fight with tigers in public shows. With the natives, especially the Guallah caste or herdsmen, they are docile: they ride on their favourites, and spend the night with them in the midst of jungles and forests, without fear of wild beasts. When driven along, the herds keep close together, so that the driver, if necessary, walks from the back of one to the other, perfectly at his convenience. The females are dangerous, while they nurse their calf. In Italy, it is asserted that buffaloes are again become wild; the domestic, however, both there and in Hungary, are managed by means of a ring passed through the cartilage of the nose: in India it is a mere rope. The practice is ancient, and it would seem that the Sclavonic *Wenden*. brought buffaloes with them to the shores of the Baltic, if we may judge from the armorial bearings of provinces and families, not unfrequent in the north of Germany and Switzerland; unless we prefer to believe that the urus or parent of the domestic ox, required to be ringed for many generations before it became tractable.—*Major Smith's Supplement to the Animal Kingdom of Baron Cuvier.*

same manner as the cow; but they are very different in the times of gestation; for the cow, as we know, goes but nine months, whereas the buffalo continues pregnant for twelve. They are all afraid of fire; and, perhaps, in consequence of this, have an aversion to red colours that resemble the colour of flame; it is said that in those countries where they are found in plenty, no person dares to dress in scarlet. In general they are inoffensive animals, if undisturbed; as indeed all those which feed upon grass are found to be; but when they are wounded, or when even but fired at, then nothing can stop their fury; they then turn up the ground with their forefeet, bellow much louder and more terribly than the bull, and make at the object of their resentment with ungovernable rage. It is happy, in such circumstances, if the person they pursue has a wall to escape over, or some such obstacle; otherwise they soon overtake, and instantly destroy him. It is remarkable, however, that although their horns are so formidable, they in general make more use of their feet in combat, and rather tread their enemies to death than gore them.

Having thus gone through the history of these animals, it may be proper to observe, that no names have been more indiscriminately used than those of the bull, the urus, the bison, and the buffalo. It therefore becomes such as would have distinct ideas of each to be careful in separating the kinds, the one from the other, allowing the cow for the standard of all. The urus, whether of the large enormous kind of Lithuania, or the smaller race of Spain, whether with long or short horns, whether with or without long hair in the forehead, is every way the same with what our common breed was before they were taken from the forests and reduced to a state of servitude. The bison and all its varieties, which are known by a hump between the shoulders, is also to be ranked in the same class.[1] This animal, whether with crooked or with straight horns, whether they be turned towards the cheek, or totally wanting, whether it be large or diminutive, whatever be its colour, or whatever the length of its hair, whether called the *bonasus* by some, or the *bubalus* by others, is but a variety of the cow kind, with which it breeds, and with which of consequence it has the closest connexion. Lastly, the buffalo, though shaped much more like the cow, is a distinct kind by itself, that never mixes with any of the former; that goes twelve months with young, whereas the cow goes but nine; that testifies an aversion to the latter; and, though bred under the same roof, or feeding in the same pasture, has always kept separate; and makes a distinct race in all parts of the world. These two kinds are supposed to be the only real varieties in the cow kind, of which naturalists have given so many varieties. With respect to some circumstances mentioned by travellers, such as that of many kinds defending themselves, by voiding their dung against their pursuers; this is a practice which they have in common with other timid creatures when pursued, and arises rather from fear than a desire of defence. The musky smell also by which some have been distinguished, is found common to many of these kinds, in a state of nature: and does not properly make the characteristic marks of any. The particular kind of noise also, which some of them are known to make, which rather resembles grunting than bellowing or lowing, is but a savage variety, which many wild animals have, and yet lose when brought into a state of tameness. For these reasons, Mr Buffon, whom I have followed in this description, is of opinion, that the zebu, or little African cow, and the grunting, or Siberian cow, are but different races of the bison; as the shape of the horns, or the length of the hair, are never properly characteristic marks of any animal, but are found to vary with climate, food, and cultivation.

In this manner the number of animals of the cow kind, which naturalists have extended to eight or ten sorts, are reduced to two; and as the utmost deference is paid to the opinion of Mr Buffon in this particular, I have taken him for my guide. Nevertheless, there is an animal of the cow kind, which neither he, nor any other naturalist that I know of, has hitherto described, yet which makes a very distinct class, and may be added as a third species.

This animal was shown some years ago in London, and seemed to unite many of the characteristics of the cow and the hog; having the head, the horns, and the tail, of the former; with the bristles, the colour, and the grunting, of the latter.[2] It was about the size of an ass, but broader and thicker; the colour resembling that of a hog, and the hair bristly, as in that animal. The hair upon the body was thin, as in the hog; and a row of bristles ran along the spine, rather shorter and softer than in the hog kind. The head was rather larger than that of a cow; the teeth were entirely resembling those of that animal, and the tongue was rough in like manner. It fed upon hay; and consequently its internal conformation must have resembled that of the cow kind more than the hog, whose food is always chosen of a kind more succulent. The eyes were placed in the head as with the cow, and were pretty nearly of the same colour; the horns were black and flattish, but bent rather backwards to the neck, as in the goat kind; the neck was short and thick, and the back rather rising in the middle; it was cloven-footed, like the cow, without those hinder claws that are found in the hog kinds. But the greatest variety of all in this extraordinary creature, which was a female, was, that it had but two teats, and consequently, in that respect, resembled neither of the kinds to which, in other circumstances, it bore so strong a similitude. Whether this animal was a distinct kind, or a monster, I will not pretend to say: it was shown under the name of the bonasus; and it was said, by the person who showed it, to have come from India: but no credit is to be given to interested ignorance; the person only wanted to make the animal appear as extraordinary as possible; and I believe would scarcely scruple a lie or two to increase that wonder in us, by which he found the means of living.

---

[1] The American bison is now ascertained to be of a distinct species from the urus. This we have stated in a previous note.

[2] The animal which Goldsmith here describes as a great curiosity was probably the *yak*, a species of bison inhabiting India and China. Most of the characteristics mentioned apply to that animal, but the grunting attributed to it should rather be called *groaning*, as the voice of the *yak*, for which it is remarkable, has more of the low groaning character than the grunt.

CHAP. III.

OF ANIMALS OF THE SHEEP AND GOAT KIND.[1]

As no two animals are found entirely the same, so it is not to be expected that any two races of animals should exactly correspond in every particular. The goat and the sheep are apparently different in the form of their bodies, in their covering, and in their horns. They may, from hence, be considered as two different kinds, with regard to all common and domestic purposes. But if we come to examine them closer, and observe their internal conformation, no two animals can be more alike; their feet, their four stomachs, their suet, their appetites, all are entirely the same, and show the similitude between them; but what makes a much stronger connection is, that they propagate with each other. The buck-goat is found to produce with the ewe an animal that, in two or three generations, returns to the sheep, and seems to retain no marks of its ancient progenitor.[2] The sheep and the goat, therefore, may be considered as belonging to one family; and were the whole races reduced to one of each, they would quickly replenish the earth with their kind.[3]

If we examine the sheep and goat internally, we shall find, as was said, that their conformation is entirely the same; nor is their structure very remote from that of the cow kind, which they resemble in their hoofs, and in their chewing the cud. Indeed, all ruminant animals are internally very much alike. The goat, the sheep, or the deer, exhibit to the eye of the anatomist the same parts in miniature which the cow or the bison exhibited in the great. But the differences between those animals are, nevertheless, sufficiently apparent. Nature has obviously marked the distinctions between the cow and the sheep kind, by their form and size; and they are also distinguished from those of the deer kind, by never shedding the horns. Indeed, the form and figure of these animals, if there were nothing else, would seldom fail of guiding us to the kind; and we might almost upon sight tell which belongs to the deer kind, and which are to be degraded into that of the goat. However, the annually shedding the horns in the deer, and the permanence in the sheep, draws a pretty exact line between the kinds; so that we may hold to this distinction only, and define the sheep and goat kind as ruminant animals of a smaller size, that never shed their horns.

---

[1] In the sheep kind the horns are hollow, wrinkled, perennial, bent backwards and outwards, into a circular or spiral form, and generally placed at the sides of the head; in the lower jaw there are eight front teeth, but none in the upper; there are no canine teeth in either, In the goat the horns are hollow, rough, compressed, and rise somewhat erect from the top of the head, and bend backwards; there are eight front teeth in the lower jaw, none in the upper, and no canine teeth in either; the chin is bearded.

[2] Buffon, passim.

[3] Sheep are so nearly allied to goats, that the distinguishing characters of the two genera are of a trivial nature. The chaffron which in the former is almost invariably more or less elevated, is in the latter occasionally of the same form; the beard is not absolutely wanting in the one, and sometimes absent in the other, and the wool which distinguishes almost all domesticated sheep, in the wild or argalis, is reduced to a rudimental state, little more prominent than in several species of antelope, of deer, and of the wild goat itself. It was believed by the ancients, that sheep are a hybrid production, and the moderns still relate that the commixture of the two species produces prolific breeds, said to be common in some parts of Russia, and also found in America, where it is known by the name of chabin. There are, however, no well authenticated facts to establish the matter beyond a doubt, and the mere carelessness of the proprietors of flocks is certainly insufficient cause for their existence; for if the two genera intermixed with facility, and remained prolific, most countries would be without the pure breed of either, and possess only the intermediate: and above all, the west coast of Africa would be in that condition, because the wool is there no object, and not the least care is taken in breeding of the domestic animals; and yet several breeds of goats and sheep exist, perfectly distinct and without the smallest appearance of having mixed at any former period. The notion of the chabin may have arisen from the sight of sheep, partly clothed with hair, and partly with wool, a breed not uncommon in northern and western Africa, from whence it may have been transported for live stock on board the slave ships to America, and preserved for curiosity or for want of better stock.

If we consider these harmless and useful animals in one point of view, we shall find that both have been long reclaimed, and brought into a state of domestic servitude. Both seem to require protection from man; and are, in some measure, pleased with his society. The sheep, indeed, is the more serviceable creature of the two; but the goat has more sensibility and attachment. The attending upon both was once the employment of the wisest and the best of men; and those have been ever supposed the happiest times in which these harmless creatures were considered as the chief objects of human attention. In the earliest ages, the goat seemed rather the greater favourite; and, indeed, it continues such, in some countries, to this day among the poor. However, the sheep has long since become the principal object of human care; while the goat is disregarded by the generality of mankind, or become the possession only of the lowest of the people. The sheep, therefore, and its varieties, may be considered first; and the goat, with all those of its kind, will then properly follow.

THE SHEEP.

Those animals that take refuge under the protection of man, in a few generations become indolent and helpless. Having lost the habit of self-defence, they seem to lose also the instincts of nature. The sheep, in its present domestic state, is, of all animals, the most defenceless and inoffensive. With its liberty, it seems to have been deprived of its swiftness and cunning; and what in the ass might rather be called patience, in the sheep appears to be stupidity. With no one quality to fit it for self-preservation, it makes vain efforts at all. Without swiftness, it endeavours to fly; and without strength, sometimes offers to oppose. But these feeble attempts rather incite than repress the insults of every enemy; and the dog follows the flock with greater delight upon seeing them fly, and attacks them with more fierceness upon their unsupported attempts at resistance. Indeed, they run together in flocks rather with the hopes of losing their single danger in the crowd, than of uniting to repress the attack by numbers. The sheep, therefore, were it exposed in its present state to struggle with its natural enemies of the forest, would soon be extirpated. Loaded with a heavy fleece, deprived of the defence of its horns, and rendered heavy, slow, and feeble, it can have no other safety than what it finds from man. This animal is now, therefore, obliged to rely solely upon that art for protection, to which it originally owes its degradation.

But we are not to impute to nature the formation of an animal so utterly unprovided against its enemies, and so unfit for defence. The moufflon, which is the sheep in a savage state, is a bold, fleet creature, able to escape from the greater animals by its swiftness, or to oppose the smaller kinds with the arms it has received from nature. It is by human art alone that the sheep has become the tardy defenceless creature we find it. Every race of quadrupeds might easily be corrupted by the same allurements by which the sheep has been thus debilitated and depressed. While undisturbed, and properly supplied, none are found to set any bounds to their appetite. They all pursue their food while able, and continue to graze, till they often die of disorders occasioned by too much fatness. But it is very different with them in a state of nature: they are in the forest surrounded by dangers, and alarmed with unceasing hostilities; they are pursued every hour from one tract of country to another; and spend a great part of their time in attempts to avoid their enemies. Thus constantly exercised, and continually practising all the arts of defence and escape, the animal at once preserves its life and native independence, together with its swiftness, and the slender agility of its form.

The sheep, in its servile state, seems to be divested of all inclinations of its own; and of all animals it appears the most stupid. Every quadruped has a peculiar turn of countenance, a physiognomy, if we may so call it, that generally marks its nature. The sheep seems to have none of those traits that betoken either courage or cunning; its large eyes, separated from each other, its ears sticking out on each side, and its narrow nostrils, all testify the extreme simplicity of this creature; and the position of its horns also, shows that nature designed the sheep rather for flight than combat. It appears a large mass of flesh, supported upon four small straight legs, ill fitted for carrying such a burden; its motions are awkward, it is easily fatigued, and often sinks under the weight of its own corpulency. In proportion as these marks of human transformation are more numerous, the animal becomes more helpless and stupid. Those which live upon a fertile pasture, and grow fat, become entirely feeble; those that want horns are found more dull and heavy than the rest;[1] those whose fleeces are longest and finest are most subject to a variety of disorders; and, in short, whatever changes have been wrought in this animal by the industry of man are entirely calculated for human advantage, and not for that of the creature itself. It might require a succession of ages before the sheep could be restored to its primitive state of activity, so as to become a match for its pursuers of the forest.

---

[1] Daubenton upon the Sheep.

The goat, which it resembles in so many other respects, is much its superior. The one has its particular attachment, sees danger, and generally contrives to escape it; but the other is timid without a cause, and secure when real danger approaches.[1] Nor is the sheep, when bred up tame in the house, and familiarized with its keepers, less obstinately absurd : from being dull and timid, it then acquires a degree of pert familiarity ; butts with its head, becomes mischievous, and shows itself every way unworthy of being singled out from the rest of the flock. Thus it seems rather formed for slavery than friendship ; and framed more for the necessities than the amusements of mankind. There is but one instance in which the sheep shows any attachment to its keeper ; and this is seen rather on the continent than among us in Great Britain. What I allude to is, their following the sound of the shepherd's pipe. Before I had seen them trained in this manner I had no conception of those descriptions in the old pastoral poets, of the shepherd leading his flock from one country to another. As I had been used only to see these harmless creatures driven before their keepers, I supposed that all the rest was but invention; but in many parts of the Alps, and even some provinces of France, the shepherd and his pipe are still continued with true antique simplicity. The flock is regularly penned every evening, to preserve them from the wolf; and the shepherd returns homeward at sun-set with his sheep following him, and seemingly pleased with the sound of the pipe, which is blown with a reed, and resembles the chanter of a bagpipe. In this manner, in those countries that still continue poor, the Arcadian life is preserved in all its former purity ; but in countries where a greater inequality of condition prevails, the shepherd is generally some poor wretch, who attends a flock from which he is to derive no benefits, and only guards those luxuries which he is not fated to share.

It does not appear, from early writers, that the sheep was bred in Britain ; and it was not till several ages after this animal was cultivated, that the woollen manufacture was carried on among us.[2] That valuable branch of business lay for a considerable time in foreign hands ; and we were obliged to import the cloth manufactured from our own materials. There were, notwithstanding, many unavailing efforts among our kings to introduce and preserve the manufacture at home. Henry the Second, by a patent granted to the weavers in London, directed, that if any cloth was found made of a mixture of Spanish wool, it should be burned by the mayor. Such edicts at length, although but slowly, operated towards the establishing this trade among us The Flemings, who at the revival of arts possessed the art of cloth-working in a superior degree, were invited to settle here ; and soon after, foreign cloth was prohibited from being worn in England. In the times of queen

---

[1] The sheep certainly is a timid animal, but this shyness, as in other ruminants, is balanced by curiosity, and when once overcome, tends to extreme confidence. It is not under the confined circumstances in which this animal is placed, but it is in the country where no direct constraint has cramped their faculties, and above all, in their wild state, that we should study and appreciate their moral qualities. If we turn our view to an intermediate state, as, for instance, the mountain sheep of Wales, half-wild from the nature of the country, we find them not crowded in close herds, because experience has taught them to feel secure from carnivora, but scattered in groups of twelve or fourteen, one of which is, nevertheless, on the look out, from a rock or a peak, to give warning of the approach of any strange object, and to give the hissing signal of retreat, when all betake themselves to the most inaccessible parts of the mountain. Such is also the practice of the American, and no doubt of all the argalis, whence the difficulty of arriving within gun-shot, which is as well known in Kamschatka as among the Cree Indians. If they be shot, it is, in general, because, feeling secure from dogs, they will stop and look with curiosity from some lofty crag upon their cry beneath, while the wary hunter steals unperceived upon them. Nor are their affections obliterated in a domestic state ; he who in shearing time, when the lambs are put up separately from the ewes, witnesses the correct knowledge these animals have of each other's voices ; the particular bleating of the mother, just escaped from the shears, and the responsive call of the lamb, skipping at the same moment to meet her ; its startled attitude at the first sight of her altered appearance, and the reassured gambol at her repeated voice and well known smell ; he who observes them at these moments, will not refuse them as great a share of intelligence as their ancient subjugation, extreme delicacy, and consequent habitual dependence on man, will allow. The courage of sheep is superior to that of goats. The males, both wild and tame, alike contend with each other for the possession of the females, by butting with the forehead and horns, running at each other with great force, so as to precipitate the vanquished sometimes over precipices of great height; and the solidity of their skulls is such, that the domestic ram, whose blows strike low, will drive a bull out of the field. Rams, and even wethers, will attack, and sometimes kill, dogs, or foxes. Instances of this kind are not uncommon in the mountainous parts of England, though they might appear incredible on the continent, where sheep enjoy less liberty. British shepherds are also well acquainted with the cunning and the arts sheep will put in practice to elude their vigilance, when a young corn field entices them to theft; and the Scottish and western mountaineers often witness their sagacity in anticipating a storm, by seeking timely shelter under a cliff, where sometimes it is necessary to dig them out of the snow, in which they become buried, without incurring any material injury.

[2] British Zoology, vol. i. p. 23.

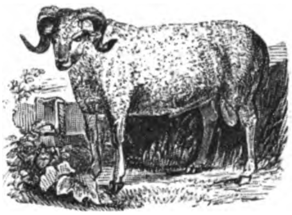
Elizabeth this manufacture received every encouragement; and many of the inhabitants of the Netherlands being then forced, by the tyranny of Spain, to take refuge in this country, they improved us in those arts, in which we at present excel the rest of the world. Every art, however, has its rise, its meridian, and its decline; and it is supposed by many, that the woollen manufacture has, for some time, been decaying amongst us. The cloth now made is thought to be much worse than that of some years past; being neither so firm nor so fine; neither so much courted abroad, nor so serviceable at home.

No country, however, produces such sheep as England; either with larger fleeces, or better adapted for the business of clothing. Those of Spain, indeed, are finer,[1] and we generally require some of their wool to work up with our own; but the weight of a Spanish fleece is no way comparable to one of Lincoln or Warwickshire; and in those counties it is no uncommon thing to give fifty guineas for a ram.

The sheep without horns are counted the best sort, because a great part of the animal's nourishment is supposed to go up into the horns.[2] Sheep, like other ruminant animals, want the upper fore-teeth: but have eight in the lower jaw: two of these drop, and are replaced at two years old; four of them are replaced at three years old; and all at four. The new teeth are easily known from the rest, by their freshness and whiteness. There are some breeds, however, in England, that never change their teeth at all; these the

---

[1] Merino is the name of a Spanish breed or variety of sheep, which affords a wool esteemed to be finer than that which any other European breed produces. In this breed the males have horns, but the females are without them. They have generally white faces and legs. The body does not seem very perfect in shape; the legs are long, the bones small; and under the throat the skin is somewhat pendulous and loose. The skin of the animal is fine and clear. When they are somewhat fat, the weight, per quarter, of the ram is about seventeen pounds, and of the ewe about eleven pounds.



The sheep of Spain are divided into two principal sorts: the common sheep, which continue on the grounds of their owners, and are housed in winter; and the merinos, which always remain in the open air, travelling before the summer to the cool mountains, and returning before the winter to the warm plains. The stationary sheep chiefly belong to the eastern provinces of Spain; while the merinos belong to the central and western parts,—the Castiles, Leon, and Estremadura. In winter they resort chiefly to the plains of the latter provinces, and in summer to the mountainous parts of Castile, which form the most elevated part of Spain, and abound in aromatic plants and fine pastures. Different accounts are given of the origin of this practice, but we have no distinct knowledge of the existence of travelling flocks in Spain until the time when the Christians began to prevail against the Mohammedans in the thirteenth century, and came down from the mountains of the north into the provinces of the centre and the south. After that time, however, the system of migration became well and firmly established; and before the Moorish kingdom of Granada had been finally reduced in the fifteenth century, the system had been organized, under the authority of the government, in nearly its present form. This we shall now proceed to describe, taking Laborde, a statistical writer on Spain, as our principal guide in the description.

There is an institution peculiar to Spain called the *Mesta*. It is a society of noblemen and other great proprietors, to whom the migratory sheep belong; who are empowered to make regulations concerning the migrations of the flocks; and who, in fact, are a great co-operative body of capitalists. Unfortunately they possess powers and privileges much at variance with the interests of the people. The term *mesta* is also applied to the great body of the migratory sheep in general; while the particular flocks are called *merinos* and *transhumantes*.

These flocks, when assembled for migration, generally consist of about ten thousand sheep. Every flock is conducted by an officer called a *mayoral*, whose business it is to superintend the shepherds and direct the route; he is generally an active man, well acquainted with the kinds of pasturage, the nature of sheep, and the method of treatment. Under him there are commonly about fifty shepherds, each of whom is allowed to keep a few sheep or goats of his own in the flock on the understanding, that although they and any young they may produce are his property, the wool and the hair belong to the proprietor of the flock. The number of persons thus employed in the care of the whole of the flocks that compose the *Mesta* are about forty-five or fifty thousand. The dogs are also very numerous, fifty being the number commonly allowed to each flock.

It is at the latter end of April, or the beginning of May, that the flocks leave the plains for the mountains. When they have been driven to the place where they are to remain, the shepherds give them as much salt as they are willing to lick; and the quantity of this article allowed for their consumption during the five summer months is one ton for every thousand sheep. At the end of July the rams are permitted to associate with the ewes, but before and after that time they are kept separate. In September the backs and loins of the sheep are rubbed with red ochre dissolved in water; and towards the end of the same month they recommence their march to the plains of Leon, Estremadura, and Andalusia. The sheep are generally conducted to the same ground which they had grazed the preceding year, and where most of the lambs were born. Here folds are constructed for the sheep, and huts of branches for the shepherds; and there they remain during the winter. The birth of the lambs takes place shortly after the arrival of the flocks in winter quarters; and particular attention is paid to prepare them by good diet for the journey in April. In March the shepherds have much to do with the lambs: they cut the tails, mark the nose with a hot iron, and saw off the points of the horns. When the time approaches for the flocks to depart for the mountains, they indicate their desire to migrate by their restlessness, and by their endeavours to escape. The shearing takes place in the month of May, during the summer

[2] Lisle's Husbandry, vol. ii. p. 155.

shepherds call the *leather-mouthed cattle;* and, as their teeth are thus long wearing, they are generally supposed to grow old a year or two before the rest.[1] The sheep brings forth one or two at a time; and sometimes three or four. The first lamb of an ewe is generally pot-bellied, short, and thick, and of less value than those of a second or third production; the third being supposed the best of all. They bear their young five months; and, by

---

journey. This business is introduced with much preparation and ceremony, and the intervals of the labour are cheered by a great deal of jollity and merry-making. The shearing is performed under cover. The animals are previously put into a building consisting of two apartments, from four to eight hundred paces long and one hundred wide. As many of the sheep as are to be sheared the following day are taken in the evening into a narrow, long, low hut, called the *sweating-house,* where, being much crowded together, they perspire freely, which renders the wool softer and more easy to be cut. This is one of the practices the Spaniards appear to have derived from the Romans. One hundred and twenty-five men are usually employed for shearing a thousand ewes, and two hundred for a thousand wethers. Each sheep affords four kinds of wool, more or less fine according to the parts of the animal whence it is taken. The rams yield more wool than the ewes, but not of so fine a quality; three rams or five ewes afford twenty-five pounds. The wool is sorted and washed before being sent away. The sheep that have been sheared are carried to another place and marked; and those which, in the course of the individual inspection they undergo on this occasion, are found to have lost their teeth, are set apart to be killed for mutton.

The journey which the flocks make in their migration is regulated by particular laws and immemorial customs. The sheep pass unmolested over the pastures belonging to the villages and the commons which lie in their road, and have a right to feed on them. They are not, however, allowed to pass over cultivated lands, but the proprietors of such lands are obliged to leave for them a path of about eighty-four yards in breadth. When they traverse the commonable pastures, they seldom travel more than six miles a day; but when they walk in close order through the cultivated fields, they often proceed upwards of eighteen miles, and they have sometimes been known to go twenty-five or thirty miles in one day, in order to reach a convenient place for halting. The whole of their journey is usually an extent of from 360 to 420 miles, which they perform in thirty or thirty-five days. Popular opinion in Spain attributes the superiority of the wool in the merino to these periodical migrations; but this appears to be disproved by the fact that the wool of the stationary sheep is sometimes equally good, and still more by the very great superiority of the wool of the German merino, which does not migrate at all. The number of the migratory sheep in Spain is at present estimated at 10,000,000, and of the stationary at 8,000,000.

The existence of the system which we have been describing is considered to constitute a great bar to agricultural improvement in Spain. The Mesta, of which we have already spoken, has a code of peculiar laws, administered by four judges, whose jurisdiction extends to all matters that are in any degree connected with the Mesta, and who take particular care that none of its privileges shall be infringed. Among the evils which the system produces, it is complained that the forty or fifty thousand persons employed in attending the sheep are lost to the state, as to the purposes of agriculture and population, as they scarcely ever marry;—that a vast quantity of good land is converted into pasturage, and produces comparatively nothing;—that great damage is committed with impunity to the cultivated lands during the journeys of the flocks—and this is so much the more injurious as at the time of the first journey, the corn is considerably advanced in its growth, and at the second, the vines are loaded with grapes;—that the commonable pastures also are so completely devastated by the migratory flocks, that the sheep of the resident population can hardly pick up a subsistence; and that the flocks of the mesta are of no use in an agricultural point of view, for, as they are never folded upon arable land, they contribute nothing to its fertilization. Besides this, the directors and shepherds are dreaded in every place to which they come, for they exercise a most intolerable despotism,—the consequence of the improper privilege which they possess of bringing whoever they may choose to insult before the tribunal of the Mesta, whose decisions are almost invariably in favour of its servants. The existence of the Mesta has therefore long been a subject of public complaint and remonstrance, and even the general states of the realm have been continually requesting the suppression of it. For a long series of years these appeals were made in vain, but about the middle of the last century the government felt itself obliged to pay some attention to the subject. A committee of inquiry was therefore appointed to take the matter into consideration, but the influence of the Mesta prevailed in the committee and elsewhere; so that though the commission is still, we believe, understood to exist, it has not *yet* given its opinion on the subject of the Mesta, or proposed any remedy for the evils it produces.

The Merino, or Spanish breed of sheep, was introduced into this country about the close of last century. George III. was a great patron of this breed, which was, for several years, a very great favourite. But it has been ascertained that, though the fleece does not much degenerate here, the carcass, which is naturally ill-formed, and affords comparatively little weight of meat, does not improve; and as the farmer, in the kind of sheep which he keeps, must look not only to the produce of the wool, but also to the butcher-market, he has found it his interest to return to the native breeds of his own country and abandon the Spanish sheep. They have, however, been of considerable service to the flocks of England, having been judiciously crossed with the South Down, Ryeland, &c. The merino was introduced into most of the other countries of Europe, in the course of the last century, with very various success. It has also at later periods been carried out to New South Wales, Van Diemen's Land, the Cape of Good Hope, and the United States; and it seems now to have been sufficiently established that, wherever the animal has been attended to for the sake of its wool, it will afford good wool, but that the quality of the wool deteriorates when that of the mutton becomes an object.

We avail ourselves of this opportunity to introduce a table of the number of sheep in some of the states of Europe as compared with the population.

	Population.	Sheep.	No. of Sheep to 1,000 Inhabitants.
Duchy of Anhalt-Bernburg....	56,000	90,000	1666
Spain..........................	13,500,000	18.700,000	1385
Great Britain and Ireland......	24,500.000	32,000,000	1306
Duchy of Brunswick..........	242 000	280,000	1157
Grand Duchy of Saxe-Weimar	222,000	250.000	1126
France.........................	32,000,000	35,000,000	1093
Hanover........................	1,550,000	1,600,000	1032
Prussia........................	12,400.000	9.000,000	725
Saxony.........................	1,400,000	1.000.000	714
Russia in Europe..............	52,600,000	36,000,000	684
Austria........................	32,000,000	12,000,000	375

---

[1] Lisle's Husbandry, vol. ii. p. 155.

being housed, they bring forth at any time of the year.

But this animal, in its domestic state, is too well known to require a detail of its peculiar habits, or of the arts which have been used to improve the breed.[1] Indeed, in the eye of an observer of nature, every art which tends to render the creature more helpless and useless to itself, may be considered rather as an injury than an improvement; and if we are to look for this animal in its noblest state, we must seek for it in the African desert, or the

---

[1] The varieties of British sheep are so numerous that at first sight it appears almost impossible to reduce them into any regular classes. They may, however, be divided in two ways: first, as to the length of their wool; and secondly, as to the presence or absence of horns. A third classification might be made after the place or districts in which such species are supposed to abound, to be in greatest perfection, or to have originated.

The long-woolled British sheep are chiefly the Teeswater, the old and new Leicester, the Devonshire nots, Exmoor, and the Heath sheep.

The short-woolled sheep are chiefly the Dorsetshire, Hereford or Ryeland, the South Down, the Norfolk, the Cheviot, the Shetland sheep, and the Merinos.

The Lincolnshire or old Leicestershire breed, have no horns, the face is white and the carcass long and thin; the ewes weighing from 14 to 20 lbs., and the three-year-old wethers from 20 to 30 lbs. per quarter. They have thick, rough, white legs, bones large, pelts thick, and wool long, from ten to eighteen inches, weighing from 8 to 14 lbs per fleece, and covering a slow-feeding, coarse-grained carcass of mutton. This kind of sheep cannot be made fat at an early age except upon the richest land, such as Romney Marsh, and the richest marshes of Lincolnshire; yet the prodigious weight of wool which is shorn from them every year, is an inducement to the occupiers of marsh-lands to give great prices to the breeders for their hogs or yearlings; and though the buyers must keep them two years more, before they get them fit for market, they have three clips of wool in the mean time, which of itself pays them well in those rich marshes. Not only the midland counties, but also Yorkshire, Durham, and Northumberland, can send their long-woolled sheep to market at two years old, fatter in general than Lincolnshire can at three. Yet this breed, and its subvarieties, are spread through many of the English counties.

The Teeswater sheep differ from the Lincolnshire in their wool not being so long and heavy; in standing upon higher, though finer boned legs, supporting a thicker, firmer, heavier carcass, much wider upon their backs and sides; and in affording a fatter and finer grained carcass of mutton: the two-year-old wethers weighing from 25 to 35 lbs. per quarter. Some particular ones, at four years old, have been fed to 55 lbs. and upwards. There is little doubt that the Teeswater sheep were originally bred from the same stock as the Lincolnshire; but, by attending to size rather than to wool, and constantly pursuing that object, they have become a different variety of the same original breed. The present fashionable breed is considerably smaller than the original species; but they are still considerably larger and fuller of *bone* than the midland breed. They bear an analogy to the short-horned breed of cattle, as those of the midland counties do to the long-horned. They are not so compact, nor so complete in their form, as the Leicestershire sheep; nevertheless, the excellence of their flesh and fatting quality is not doubted, and their wool still remains of a superior staple. For the banks of the Tees, or any other rich fat-land county, they may be singularly excellent.

The Dishley, or new Leicester breed, is distinguished from other long-woolled breeds by their clean heads, straight, broad, flat backs, round barrel-like bodies, very fine small bones, thin pelts, and inclination to make fat at an early age. This last property is most probably owing to the before-specified qualities, and which, from long experience and observation, there is reason to believe, extends through every species of domestic animals. The Dishley breed is not only peculiar for its mutton being fat, but also for the fineness of the grain, and superior flavour, above all other large long-woolled sheep, so as to fetch nearly as good a price, in many markets, as the mutton of the small Highland and short-woolled breeds. The weight of ewes, three or four years old, is from 18 to 26 lbs. a quarter, and of wethers, two years old, from 20 to 30 lbs. The wool, on an average, is from 6 to 8 lbs. a fleece.

The Devonshire Nots have white faces and legs, thick necks, narrow backs, and backbone high; the sides good, legs short, and the bones large; weight much the same as the Leicesters; wool heavier, but coarser. In the same county, there is a small breed of long-woolled sheep, known by the name of the *Exmoor* sheep, from the place where they are chiefly bred. They are horned, with white faces and legs, and peculiarly delicate in bone, neck, and head; but the form of the carcass is not good, being narrow and flat-sided. The weight of the quarters, and of the fleece, about two-thirds that of the former variety.

The shorter woolled varieties, and such as, from their size and form, seem well suited to hilly and inferior pastures, are also numerous. Generally speaking, they are too restless for enclosed arable land, on the one hand; and not sufficiently hardy for heathy mountainous districts, on the other. To this class belong the breeds of Dorset, Hereford, Sussex, Norfolk, and Cheviot.

The Dorsetshire sheep are mostly horned, white faced, stand upon high small white legs, and are long and thin in the carcass. The wethers three years and a half old, weigh from 16 to 20 lbs. a quarter. The wool is fine and short, from 3 to 4 lbs. a fleece. The mutton is fine grained and well flavoured. This breed has the peculiar property of producing lambs at almost any period of the year, even so early as September and October. They are particularly valued for supplying London and other markets with house lamb, which is brought to market by Christmas, or sooner if wanted, and after that a constant and regular supply is kept up all the winter.

The Wiltshire sheep are a variety of this breed, which, by attention to size, have got considerably more weight; viz. from 20 to 28 lbs. a quarter. These, in general, have no wool upon their bellies, which gives them a very uncouth appearance. The variations of this breed are spread through many of the southern counties, as well as many in the west, viz. Gloucestershire, Worcestershire, Herefordshire, &c.; though some of them are very different from the Dorsetshire, yet they are, Culley apprehends, only variations of this breed, by crossing with different tups; and which variations continue northward until they are lost amongst those of the Lincolnshire breeds.

The Herefordshire breed is known by the want of horns, and their having white legs and faces, the wool growing close to their eyes. The carcass is tolerably well formed, weighing from 10 to 18 lbs. a quarter, and bearing very fine short wool, from 1½ to 2½ lbs. a fleece: the mutton is excellent. The store or keeping sheep of this breed are put into cots at night, winter and summer, and in winter foddered in racks with pea-straw, barley-straw, &c., and in very bad weather with hay. These cots are low buildings, quite covered over, and made to extensive plains of Siberia. Among the degenerate descendants of the wild sheep, there have been so many changes wrought, as entirely to disguise the kind, and often to mislead the observer. The variety is so great, that scarcely any two countries have their sheep of the same kind; but there is found a manifest difference in all, either

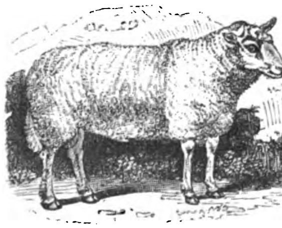
---

contain from one to five hundred sheep, according to the size of the farm or flock kept. The true Herefordshire breed are frequently called *Ryeland* sheep, from the land formerly being thought capable of producing no better grain than rye; but which now yields every kind of grain. A cross between this breed and the merinos was extensively cultivated by the late Dr Parry, of Bath, an eminent wool-grower, and promoter of agricultural improvement.

The South Down sheep are without horns: they have dark or black-grey faces and legs, fine bones, long small necks; are low before, high on the shoulder, and light in the fore quarter; the sides are good, and the loin tolerably broad, back-bone too high, the thigh full, and twist good. The fleece is very short and fine, weighing from 2¼ to 3 lbs. The average weight of two years old wethers is about 18 lbs. per quarter, the mutton fine in the grain, and of an excellent flavour. These sheep have been brought to a high state of improvement by Elman, of Glynd, and other intelligent breeders. They prevail in Sussex, on very dry chalky downs, producing short fine herbage.

In the Norfolk sheep the face is black, horns large and spiral, the carcass is very small, long, thin, and weak, with narrow chines, weighing from 16 to 20 lbs. per quarter; and they have very long dark or grey legs, and large bones. The wool is short and fine, from 1¾ to 2 lbs. per fleece. This race have a voracious appetite, and a restless and unquiet disposition, which makes it difficult to keep them in any other than the largest sheep-walks or commons. They prevail most in Norfolk and Suffolk, and seem to have been retained chiefly for the purpose of folding. As fatteners, they are not profitable; but the mutton produced is inferior to none. A three or four year old Norfolk wedder will produce a haunch, which, if kept two or three weeks, will vie with that of any animal excepting a buck.

The Cheviot breed are without horns, the head bare and clean, with jaws of a good length, faces and legs white. The body is long, but the fore-quarters generally want depth in the breast, and breadth both there and on the chine; though, in these respects, great improvement has been made of late. They have fine clean, small-boned legs, well covered with wool to the hough. The weight of the carcass, when fat, is from 12 to 18 lbs. per quarter; their fleece, which is of a medium length and fineness, weighs about 3 lbs. on an average. Though these are the general characters of the pure Cheviot breed, many have grey or dun spots on their faces and legs, especially on the borders of their native districts, where they have intermixed with their black-faced neighbours. On the lower hills, at the extremity of the Cheviot range, they have been frequently crossed with the Leicesters, of which several flocks, originally Cheviot, have now a good deal both of the form and fleece. The best kind of these sheep are certainly a very good mountain stock, where the pasture is mostly green sward, or contains a large portion of that kind of herbage, which is the case of all the hills around Cheviot, where those sheep are bred. Large flocks of them have been sent to the Highlands of Scotland, where they have succeeded so well as to encourage the establishment of new colonies; yet they are by no means so hardy as the heath or black-faced kind, which they have, in many instances, supplanted.



Of those races of sheep that range over the mountainous districts of Britain, the most numerous, and the one probably best adapted to such situations, is the *heath* breed, distinguished by their large spiral horns, black faces and legs, fierce, wild-looking eyes, and short, firm carcasses, covered with long, open, coarse shagged wool. Their weight is from 10 to 16 lbs. a quarter, and they carry from 3 to 4 lbs. of wool each. They are seldom fed until they are three, four, or five years old, when they fatten well, and give excellent mutton, and highly flavoured gravy. Different varieties of the sheep are to be found in all the western counties of England and Scotland, from Yorkshire northwards, and they want nothing but a fine fleece to render them the most valuable upland sheep in Britain.

The Herdwick sheep are peculiar to that rocky mountainous district at the head of the Dudden and Esk rivers, in the county of Cumberland. They are without horns, have speckled faces and legs, wool short, weighing from 2 to 2¼ lbs. per sheep, which, though coarser than that of any of the other short-woolled breeds, is yet much finer than the wool of the heath sheep. The mountains upon which the Herdwicks are bred, and also the stock itself, have, time immemorial, been farmed out to herds, and from this circumstance their name is derived.

The Dun-faced breed, said to have been imported into Scotland from Denmark or Norway at a very early period, still exists in most of the counties to the north of the Frith of Forth, though only in very small flocks Of this ancient race there are now several varieties, produced by peculiarities of situation, and different modes of management, and by occasional intermixture with other breeds. We may, therefore, distinguish the sheep of the mainland of Scotland from those of the Hebrides, and of the northern islands of Orkney and Zetland.

The Hebridean sheep is the smallest animal of its kind. It is of a thin, lank shape, and has usually straight short horns. The face and legs are white, the tail very short, and the wool of various colours; sometimes of a bluish grey, brown, or deep russet, and sometimes all these colours meet in the fleece of one animal. Where the pasture and management are favourable, the wool is very fine, resembling in softness that of Shetland; but, in other parts of the same islands, the wool is stunted and coarse, the animal sickly and puny, and frequently carries four, or even six horns. The average weight of in the size, the covering, the shape, or the horns.

The woolly sheep,[1] as it is seen among us, is found only in Europe, and some of the temperate provinces of Asia. When transported into warmer countries, either into Florida or Guinea, it loses its wool, and assumes a covering fitted to the climate, becoming hairy and rough; it there also loses its fertility, and its flesh no longer has the same flavour. In the same manner, in the very cold countries, it seems equally helpless and a stranger; it still requires the unceasing attention of mankind for its preservation; and although it is found to subsist as well in Greenland as in Guinea,[2] yet it seems a natural inhabitant of neither.

Of the domestic kinds to be found in the different parts of the world, besides our own, which is common in Europe, the first variety is to be seen in Iceland, Muscovy, and the coldest climates of the north.[3] This, which may be called the Iceland sheep, resembles our breed in the form of the body and the tail; but differs in a very extraordinary manner in the number of the horns; being generally found to have four, and sometimes even eight, growing from different parts of the forehead. These are large and formidable, and the animal seems thus fitted by nature for a state of

---

this poor breed, even when fat, is only 5 or 5½ lbs. per quarter, or nearly about 20 lbs. per sheep. It is often much less, only amounting to 15 or 16 lbs.; and the price of the animal's carcass, skin and all, is from 10s. to 14s. Fat wedders have been sold in the Long island at 7s. a head, and ewes at 5s. or 6s. The quantity of wool which the fleece yields is equally contemptible with the weight of the carcass. It rarely exceeds one pound weight, and is often short of even half that quantity. The quality of the wool is different on different parts of the body; and inattention to separate the fine from the coarse, renders the cloth made in the Hebrides very unequal and precarious in its texture. The average value of a fleece of this aboriginal Hebridean breed is from 8*d.* to 1*s*. sterling. From this account it is plain, that the breed in question has every chance of being speedily extirpated.

Of the Zetland sheep it would appear that there are two varieties, one of which is considered to be the native race, and carries very fine wool; but the number of these is much diminished, and in some places they have been entirely supplanted by foreign breeds; the other variety carries coarse wool above, and soft fine wool below. They have three different successions of wool yearly, two of which resemble long hair more than wool, and are termed by the common people *fors* and *scudda*. When the wool begins to loosen in the roots, which generally happens about the month of February, the hairs, or scudda, spring up; and when the wool is carefully plucked off, the tough hairs continue fast until the new wool grows up about a quarter of an inch in length, then they gradually wear off; and when the new fleece has acquired about two months' growth, the rough hairs, termed *fors*, spring up and keep root until the proper season for pulling it arrives, when it is plucked off along with the wool, and separated from it, at dressing the fleece, by an operation called forsing. The scudda remains upon the skin of the animal as if it were a thick coat, a fence against the inclemency of the seasons, which provident nature has furnished for supplying the want of the fleece. The wool is of various colours; the silver grey is thought to be the finest, but the black, the white, the *mourat*, or brown, is very little inferior, though the pure white is certainly the most valuable for all the finer purposes in which combing wool can be used. In the northern part of Kincardineshire, as well as in most other of the northern counties, there is still a remnant of this ancient race, distinguished by the yellow colour of the face and legs, and by the dishevelled texture of the fleece, which consists in part of coarse, and in part of remarkably fine wool. Their average weight in that county is from seven to nine pounds a quarter, and the mutton is remarkably delicate and highly flavoured. The Highland Society of Scotland have offered premiums for the improvement of this breed.

[1] Buffon, vol. xxiii. p. 168.

[2] Krantz.

[3] As Asia seems to exhibit the most numerous and finest varieties in the breeds of domestic goats, so Africa might claim the greatest number of distinct varieties of sheep, from those approaching nearest to their supposed primitive characters, to the ultimate degree of deterioration which can exist without extinction. The gradations in the scale of domestication, appear to be distinguishable, in the first place, by a decrease of bulk in the horns, retaining the original direction, or passing into the elongated spiral turns; by a partial retention of hair on the body, more or less mixed with wool; by the local accumulation of fat on certain parts; by the expansion and drooping of the ears; the lengthening of the tail; by the arching of the nasal bones or chaffron; and last, by the wool changing from white to dark brown and black. In proportion as one or more of these characters combined are observed, the breed recedes from the original type; but in reviewing the races by these indications, regard must still be had to the obvious influences of climate and circumstances.

The principal breeds of Africa are the *Adimain or Long-legged* sheep, remarkable for elevated legs, and robust make, notwithstanding they have hollow flanks. In height at the shoulder, the ram measures three feet, and in length exceeds four feet six inches. The chaffron is more or less arched, the ears horizontal, the tail invariably very long, and the neck short. On the croup, back, and flanks, there is wool, varying in the degrees of fineness; but from the nape of the neck to the shoulders, a heavy mane of hair hangs down to the breast. The horns in general are short, forming a segment of a circle round the ears. Of this race there are several subordinate breeds, the first, or

Morocco breed, has long wool; the hair on the neck rather shorter and more undulating, of a rufous brown; the ears small, horizontal; the horns small, turning spirally outwards, and the scrotum forming two separate sacks: general colour white, with some marks of liver colour. A specimen sent by one of the princes of Morocco was in the possession of Sir J. Banks.

The Emmema or Guinea breed is the second, and well known by the figures of Marcgrave, Buffon, and M. F. Cuvier. The horns of this animal form a semicircle with the points forwards, rather robust and short. The females are hornless. There is usually some black distributed about the sides of the head and to the neck; and in proportion as this colour spreads in the specimens we have seen, the horns were observed to decrease in size, the ears to become more pendulous, and at last wattles were found near the throat. Of this sort was a large ram from Guinea, nearly without wool, white in colour, but with large black spots on the head, shoulders, flanks, and legs; on the neck there was a beautiful mane of long silky white hairs. It is this breed which was formerly introduced into Holland, and kept upon the war; however, it is of the nature of the rest of its kind, being mild, gentle, and timid. Its wool is very different also from that of the common sheep, being long, smooth, and hairy. Its colour is of a dark brown; and under its outward coat of hair it has an internal covering, that rather resembles fur than wool, being fine, short, and soft.

---

islands near the Texel, and in Groningen, by means of which the cross breed with long legs and long wool was reared, which bred twice a-year. It is also found with little variation, in the Fezzan.

The Congo is a third breed of the above race, with similar proportions, but still hollower flanks, very arched chaffron, meagre and powerless, and instead of wool, covered with loose hair, slightly lengthened beneath the throat; the horns very short, turned back upon the neck; the ears pendulous, two wattles beneath the throat; the tail very long, slender, and almost naked. The females without horns; and the general colours of the fur consisting in large clouds of pale rufous-brown upon white.

The Muana Conquo, Coquo, and *Zomba*, Angola breeds, are better proportioned. The form of the chaffron is as in the breeds of Europe; the horns small; in the first and third turning from the head; in the Coquo forming a commencement of the usual curve. This species has also more and finer wool, and in general, bears a black spot round the eyes; the others are more hairy; all have the tail very long, the ears only horizontal, and their general colour is white, with broad spots of rufous.

The Zunu or *Goitered* breed, is a fourth of the Angola race, low on the legs, with close hair, pendulous ears, and tail reaching to the fetlocks. It is very delicate, and has the singular peculiarity of a mass of fat rising in the form of a high collar behind the horns, and resting upon the occiput; the horns are very short, slender, turned inwards towards the forehead; upon the larynx another mass of fat hangs like a goitre under the throat; the forehead is so prominent that a deep depression occurs between the eyes: the ears, neck, body, and superior part of the tail, are pale brown; the head, goitre, throat, legs, belly, and inferior half of the tail, white.

At the Cape of Good Hope, several breeds are found, the Dutch imported from Holland, the Indian from Ceylon, and the Indigenous or *Hottentot Broad-tailed* sheep. Besides these, other intermediate sorts have arisen by crossing between them; but the Broad-tailed, or Hottentot sheep, is the true South African, and now found also in Madras and Bengal. It is beneath the ordinary size. The males generally, the females always, without horns, handsomely made, the tail lower than the houghs, ending in a sharp point, the end of which is turned up, with a considerable expanse of fat beneath, rather thick, and not spread laterally; the wool is replaced by very soft and short white hair, with a fulvous spot round each eye; the same on the tips of the ears, the knees, fetlocks, and houghs. It is a very delicate breed, and almost useless if taken on board for sea-stock, wasting and perishing in the first gale of wind. This breed is one of a vast race, spreading, with various modifications, over Egypt, Barbary, the Levant, India, China, and Russia. Their name of broad-tailed, common to the whole race, is derived from one or two masses of fat extending, with some variation of shape, on each side of the inferior part of the tail, where it is invariably naked and flesh-coloured. Mr Pennant mentions a second breed of this race also from South Africa, with large pendulous ears, a convex face, small horns, and a long tail. There is a third which may be a cross with the Dutch. The chaffron is nearly straight, the ears small, horizontal; horns rather large, stretching at right angles from the head. It is a large variety; the head commonly black; the ears white, the wool on the forehead and body mostly white and coarse; the tail broad, with two lobes of fat at the sides, reaching to the houghs.

The *Barbary* and *Egyptian Broad-tailed* breed is more rufous on the neck, legs, tail, ears, and nose; the wool is coarse, the face not much arched, the ears pendulous, and the horns retain the original curve of the argalis on a smaller scale. In this breed the tail is long, and at base wider than the buttocks.

The last African race we shall notice, is found in Barbary, and even in Corsica. It is policerate, with pendulous ears; the tail not much widened, white in colour; posterior parts covered with wool; and from the head to the shoulders with loose soft hair. A crossed breed of this race with the Emmemas, and brought from Guinea, was in the possession of R. Wilding, Esq. It was entirely covered with soft silky hair, of a silvery whiteness; on the fore and hind part of the neck the hair was of a great length, especially in front; half of the nose was jetty black; on each knee and on each thigh a black spot; the fetlocks and feet white. In the month of November it began to assume a soft woolly coat, like that of English sheep, so forcibly was it influenced by the climate. It was at first very gentle, attending its master in his walks, and leaping over the styles in the path; but being introduced to other sheep, it became vicious, and was sent to a mountain inclosure, where it died.

The Asiatic sheep are partly of the same broad-tailed race as the Africans. Pallas mentions one with very few caudal vertebræ, but loaded on each side with a considerable and rounded mass of fat, separated beneath, but uniting at the tail. It has a coarse wool, is often dark-coloured, almost black; the hoofs are long, and the ears pendulous. This breed is found in China, Persia, and Southern Russia. The celebrated *Astracan* breed, which extends over Chorazan, about Meschet, and in the Kerman or ancient Caramania, is remarkable for the fine spirally curled wool of a gray or mixed black and white colour which is obtained from it. The sheep are below the ordinary size; the horns of the ram curved back and spiral at the tip; the ears pendulous; the colour dirty white, with a fine gray wool beneath; the tail not very broad. The fine furs are of the lambs slain with the dam a few days before yeaning. Some are black. There is another Russian breed without horns; the chaffron not much arched; having wattles under the throat; ears pointing downwards and forwards; a yellow face and a very short broad tail; the wool is white, and of good quality. The last broad-tailed breed of Northern and Middle Asia, is policerate, with the ears pointing forward and down, as in the former. The horns are four, five, and even six; the chaffron very convex; wattles under the throat, and very coarse wool. This breed forms the flocks of the Kirguise, and range along the banks of the Volga and Jennissai.

The *Steatopyga* or *Fat-rumped Sheep*, are of another race, principally reared in Southern Tartary. They have small or no horns; the chaffron not quite straight, the mouth small and pointed; long pendulous ears, and the tail very short and without fat; some have wattles; the wool is of good quality, but mixed colours, be-

The second variety to be found in this animal, is that of the broad-tailed sheep, so common in Tartary, Arabia, Persia, Barbary, Syria, and Egypt. This sheep is only remarkable for its large and heavy tail, which is often found to weigh from twenty to thirty pounds. It sometimes grows a foot broad, and is obliged to be supported by a small kind of

---

ing white and roan or light-brown in the rams, and black and white in the ewes. A variety of this, seemingly crossed with the Astracan, forms a breed in the *Mysore*. It is hornless, with narrow pendulous ears, a very short clean tail, and the wool, very fine, is particularly curled in small meshes, shaped like a cork-screw; the eyes are blue, and the colour pure white. It is the most beautiful breed of India. The late Sir Joseph Banks had a specimen which came from the gardens of Tippoo Sultan at Seringapatam.

India and China are, besides, in possession of a breed which seems allied to the African Adimain race. It is rather high on the legs, with middle-sized curved horns, a collar of hair reaching to the shoulders, which, together with the head and legs, is deep rufous-brown. On the body there is a short whitish and coarse wool, rather curling, and the tail more hairy, reaches below the houghs, and is rufous.

The Dolichura, or Circassian breed, has a very long tail, trailing to the ground; middle sized horns, twisting spirally from the side of the head, and very coarse wool, often black.

Rocky Mountain Sheep.—The following information concerning this highly interesting animal is chiefly the copy of a letter addressed to the Philadelphia Agricultural Society. The Rocky Mountain sheep inhabit the elevated region comprised in that portion of the mountain range from which its name is derived, situated between the 48th and 60th parallels of north latitude. They are found in great numbers near the head waters of the north fork of Columbia river, where their flesh constitutes the principal food of the natives. The country at the sources of Muddy river, (Marais river of Lewis and Clark,) Saskatchawin and Athabaska rivers are also inhabited by them; but they are said to be less numerous on the eastern slope of the Rocky Mountains than upon the western; they are seldom or never seen at a distance from the mountains, the climate and productions of which appear best adapted to their nature and mode of life. In summer they resort to the peaks and ridges in quest of pasture, but retire to the valleys in winter. The size of the animal is nearly the same as that of the common sheep; their fleece is white, interspersed with long hair, protruding beyond the wool, and standing erect on the surface of the body, which gives them a shaggy appearance; their horns are short, merely projecting beyond the wool of the head, and slightly arcuated backwards; these, together with their hoofs, are black, while the other parts of their bodies are uniformly white; their flesh has a musky flavour, and is, at best, unsavoury. They are of easy access to the hunter, who seldom pursues them unless compelled by hunger. Their fleece is esteemed of little value by the traders, and is used only as a covering to the feet during winter; their skin is of a remarkably thick and spongy texture. It has been asserted by good judges, that the silky fineness of the wool is not surpassed by that of the Cashmere goat.

The Puruk Sheep of Ladusk.—An interesting paper read by Mr Moorecraft, before the *Royal Asiatic Society*, in particularly noticing a singular breed of sheep, of the Himalaya Mountains, says, "The Puruk sheep of Ladusk, when at full growth, is scarcely as large as a South Down lamb, six months old; yet in fineness and weight of fleece, and flavour of mutton, added to its peculiarities of feeding and constitution, it yields not in merit to any race hitherto described. It gives two lambs in twelve months, and is twice shorn within that space: the clip may afford, in the annual aggregate, 3 lbs. and the first yield is fine enough for tolerably good shawls. The British flockmaster would be delighted with the fineness of the bone, the spread of the carcass, the hardiness of its constitution, and its aptness to fatten. The Puruk sheep, if permitted, thrusts its head into the cooking-pot, picks up crumbs, is eager to drink the remains of a cup of salted and buttered tea, or broth, and examine the hand of its master for barley, flour, or for a cleanly picked bone, which it disdains not to nibble; a leaf of lettuce, a peeling of turnip, the skin of the apricot, are a luxury: and the industry is indefatigable with which this animal detects and appropriates substances so minute and uninviting, as would be unseen and neglected by ordinary sheep: perhaps the dog of the cottager is not so completely domesticated as it is. I have been minutely tedious upon their acquired habits of feeding, as introductory to the conclusion that there exists not a cottager in Britain who might not keep three of these sheep with more ease than he now keeps a cur dog; nor a little farmer, who might not maintain a flock of fifteen or twenty without appropriating half an acre exclusively to their use: they would derive support from that produce which now either totally runs to waste, or goes to the dunghill. I have procured some of the sheep, and mean to increase the stock to two hundred, leaving them under the care of a respectable lama for two years, at the end of which period my journey will have been completed. Should I fall, an event by no means impossible, government will receive them as a legacy, without expense, under the hope that some of the individuals will be sent to Britain; and in the sure expectation that the progeny will be distributed to cottagers and small farmers in poor and dry countries."

Among the European varieties,

The Many-horned of Iceland seems to be derived from the Russian policerate breed. They are small, with very irregular horns, three, four or five, in number, never spiral, but variously bent. They have a covering of long coarse hair, beneath which lies a coarse thick wool, and next to the skin a finer down. Their colour is rusty brown; the legs very small, and the hoofs narrow, long, and irregular, seem to acquire this form from their continual residence upon snow, which does not wear them down. Some of these sheep are housed in winter, but others are nearly wild, shifting for themselves, and often buried under the snow for many days. Yet a good ewe yields from two to six quarts of milk per day, from which butter and cheese are made. They are not shorn, the fleece coming off at once, when the young wool is somewhat advanced (about the month of May). There is, besides, in Iceland, a large white breed, with similar horns as the former, but probably obtained by crossing with some continental race.

In Corsica, the white policerate race, with coarse straight wool, and small ears, seems derived from the Barbary breed.

A second race of Europe, with horns of a peculiar character, so as to have been regarded as forming a distinct board, that goes upon wheels. This tail is not covered underneath with wool, like the upper part, but is bare; and the natives, who consider it as a very great delicacy, are very careful in attending and preserving it from injury. Mr Buffon supposes that the fat which falls into the caul in our sheep, goes in these to furnish the tail; and that the rest of the body is from thence deprived of fat in proportion. With regard to their fleeces, in the temperate climates, they are, as in our own breed, soft and woolly; but in the warmer latitudes, they are hairy: yet in both they preserve the enormous size of their tails.

The third observable variety is that of the sheep called *strepsicheros*. This animal is a native of the islands of the archipelago, and only differs from our sheep, in having straight horns, surrounded with a spiral furrow.

The last variety is that of the Guinea sheep, which is generally found in all the tropical climates, both of Africa and the East Indies. They are of a large size, with a rough hairy skin, short horns, and ears hanging down, with a kind of dewlap under the chin. They differ greatly in form from the rest, and might be considered as animals of another kind, were they not known to breed with other sheep. These of all the domestic kinds, seem to approach the nearest to the state of nature. They are larger, stronger, and swifter, than the common race; and, consequently, better fitted for a precarious forest life. However, they seem to rely, like the rest, on man for support; being entirely of a domestic nature, and subsisting only in the warmer climates.

Such are the varieties of this animal, which have been reduced into a state of domestic servitude.[1] These are all capable of producing among each other; all the peculiarities of their form have been made by climate and human cultivation; and none of them seem sufficiently independent to live in a state of savage nature. They are, therefore, to be considered as a degenerate race, formed by the hand of man, and propagated merely for his benefit. At the same time, while man thus cultivates the domestic kinds, he drives away and destroys the savage race, which are less beneficial, and more headstrong. These, therefore, are to be found in but a very small number, in the most uncultivated countries, where they have been able to subsist by their native swiftness and strength. It is in the more uncultivated parts of Greece,[2] Sardinia, Corsica,

---

species, and named Strepsicheros by the moderns, is the *Cretan*. The animals are of handsome form, with long horns, having a strong ridge in front; the ram is distinguished by having them usually in the form of a complete spiral circle at the base, and then three additional spiral twists ascending vertically; the ears are small, drooping; the tail long; and the whole body covered with undulating wool, of rather a coarse quality; the face and legs are often speckled, or even entirely black. In the females the horns are divergent, straight, and twisted into four turns on their own axis. Their colour is white, and stature equal to the common sheep.

The *Wallachian* breed is derived from the Cretan, and resembles the old unimproved breed of England in form, shape of the ears, and voluminous scrotum, but the wool, though curling, is rather coarse, and straight on the thighs and tail; the horns are very long, marked with a prominent ridge, diverging almost at right angles from the head, and twisted in a lax spiral form, into two turns and a half. The breed is white.

Sheep are bred to a great extent in New South Wales, and sheep farming now constitutes the chief employment of the New South Wales colonist. The wool is excellent, and several million pounds of it are annually exported to Europe.

[1] The following table exhibits a view of the principal breeds of sheep in Great Britain:—Teeswater, long wool, no horns—Lincoln, long wool, no horns—Dishley, or New Leicester, long wool, fine, no horns—Cotswold, long wool, fine, no horns—Romney Marsh, long wool, fine, no horns—Dartmoor, or Bampton, long wool, fine, no horns—Exmoor, long wool, coarse, horned—Black-faced or Heath, long wool, coarse, horned—Hereford, Ryeland, short wool, fine, no horns—Morf, Shropshire, short wool, fine, horned—Dorset, short wool, fine, horned—Wilts, short wool, middling, horned—Berks, long wool, no horns—South Down, short wool, no horns—Norfolk, short wool, horned—Herdwick, short wool, horned—Cheviot, short wool, no horns—Dunfaced, short wool, no horns—Shetland, fine cottony wool, no horns—Spanish, short wool, superfine, rams horned—Spanish Cross, short wool, fine.

According to Mr Luccock's Treatise on English Wool, he estimates the number of long-woolled sheep in England and

Wales in 1800 to be	4.153,388
Of short-woolled sheep	14,854,219
Total number shorn,	19.007,607
Slaughter of short-woolled sheep per annum	4,221,748
Carrion of ditto	211,067
Slaughter of long-woolled sheep	1,180,413
Carrion of ditto	59.030
Slaughter of lambs	1,400 568
Carrion of ditto	70,028
Total number of sheep and lambs	26,148,463

In the General Report of Scotland (vol. iii. App. p. 6), the number of sheep is estimated at 2,850,000; and allowing for the increase that has taken place since 1814, we may perhaps estimate the total number of sheep in that part of the empire at this time at 3,500,000.

According to Mr Wakefield, there is not a single flock of breeding sheep in the whole province of Ulster. And though there be considerable flocks in Roscommon and other counties, it is believed that, if the whole number of sheep in Ireland be estimated at 2,000,000, it will be a good deal beyond the truth.

On the whole, therefore, if these estimates be right, the total number of sheep in Great Britain and Ireland may be taken at about 32,000,000.

[2] The Rev. John Hartley, who has travelled as a missionary in Greece, records in his Journal the following interesting scriptural illustration:—"Having had my attention directed last night to the words, (John x. 3.) —*The sheep hear his voice, and he calleth his own sheep by name*, &c., I asked my man if it was usual in Greece to give names to sheep. He informed me that it was, and that the sheep obeyed the shepherd when he called them by their names. This morning I had an opportunity of verifying the truth of this remark. Passing by a flock of sheep, I asked the shepherd the same question which I put to my servant, and he gave me the same answer. I then bade him to call one of his sheep.

and particularly in the deserts of Tartary, that the moufflon is to be found, that bears all the marks of being the primitive race; and that has been actually known to breed with the domestic animal.[1]

The moufflon, or musmon, though covered with hair, bears a stronger similitude to the ram, than to any other animal: like the ram, it has the eyes placed near the horns, and its ears are shorter than those of the goat; it also

---

He did so, and it instantly left its pasturage and its companions, and ran up to the hand of the shepherd, with signs of pleasure, and with a prompt obedience which I had never before observed in any other animal. It is also true of the sheep in this country, *that a stranger will they not follow, but will flee from him; for they know not the voice of the strangers.* The shepherd told me that many of his sheep are still WILD; that they had not yet learned their names; but that by teaching they would all learn them. The others which knew their names, he called TAME."

[1] The high mountains of Bhootan are frequented by an animal of this genus, known by the name of Nervati, or wild sheep of Bhote, and is represented as similar in colour, and in the texture of the hair, to the chiru, that is, a slaty, bluish grey, inclining to red, and concealing, beneath the general superficies, a spare fleece of very soft wool, which lies close to their skin. This colour is, probably, not unlike that of the musmon, or a liver-coloured gray; but it may be that the nervati is of a different species, and even of a different genus, because we have no account of the horns.

The *Asiatic Argali.* (*Ovis Ammon.*) This species, observed and described by Gmelin and Pallas, is perhaps the pygargus and ophion of the ancients. Several of its Asiatic names have a reference to the white rump.

The male is not much inferior in size to a stag, individuals having been killed that weighed considerably above two hundred pounds. He is about three feet high at the shoulders, and nearly five feet in length. The horns are very large, sometimes near four feet long, and weighing upwards of thirty pounds; their width is so considerable at the base, that young foxes are said to shelter themselves in such as are found casually on the ground; they rise near the eyes, before the ears, occupying the greater part of the back of the head, and nearly touching above the forehead, bending at first backwards and downwards, then to the front, and the points finally outwards and upwards; their base is triangular, with the broadest side towards the forehead; the surface is wrinkled crossways to beyond their middle, but the extremity is more smooth. Some variation of form occurs in the argalis of Caucasus, their horns being often only semicircular, almost round at the base, extremely heavy and stout, dark brown, with scarce any wrinkles, not tapering, but ending in a stumpy form. The fur of the animal consists of short hair, fulvous-gray in winter, with a ferruginous buff-coloured streak along the back, and a large disk of whitish buff on the buttocks, including the tail; the internal side of the limbs and the belly are still paler, and the chaffron, nose, and throat, are white. In summer the whole fur is more rufous, but the buff-coloured mark on the buttocks remains unaltered. The female is smaller, with slender horns, nearly straight, and small wrinkles, resembling those of a domestic goat; the colours of the hair are nearly the same, but paler, and without the disk on the buttocks; both have the face rather straight, the tail very short, the eye-lashes whitish, the skin beneath the throat lax, and covered with longer hair, and a close wool concealed by the outer coat.

The argali inhabits the highest mountains of central Asia, the Caucasus, Kamschatka, and the elevated steppes and plains of Siberia, &c. The males fight fiercely in the manner of the common ram; they breed twice in the year, in spring and autumn, and produce one or two lambs at a birth. These are at first covered with a fine fur, and if taken they are easily domesticated; but the adults remain always intractable. They are strong and active, flying from the least danger, always in a direction of the most inaccessible ground, but their motion is from side to side, like that of the domestic sheep, and stopping in their course to look at the pursuer. The flesh is esteemed very savoury, and the skins, now becoming more rare in Russia, fetch a good price on the spot, to be converted into articles of clothing. In the autumn, when they descend from the mountains, they are very fat, but in the spring they are lean, from want of choice food, and from licking salt, before they again ascend to the sunny glens of the high mountains.

The *American Argali.* (*O. Pygargus.*) This animal was known in the time of Hernandez, by the name of sheep of California; Venegas and Clavighero, afterwards noticed it, and the Canadian fur traders have long been acquainted with it by the name of Culblane; but Mr M'Gillivray after his travels in the Rocky mountains in 1800, first drew the attention of zoologists more particularly to the species, and its spoils have since been transmitted to Philadelphia and London. In size and form, it resembles the former, being also about three feet high at the shoulder, and four feet six inches in length, but the horns are still larger and more perfectly spiral, measuring above fifteen inches each at their base, and the pair covering the sides of the head from near the eyes to the occiput, touching at the top of the forehead. This structure lengthens the head, raising the forehead high between them, and depressing its articulation below the orbits: their triangular character is almost effaced by the arching of the sides. In old specimens the wrinkles are not very prominent, and the tips are commonly broken off. The face and mouth are white; the cheeks, neck, back, and limbs, dun rufous-gray; the tail, about five inches long, together with the buttocks and part of the croup, is inclosed in a disk of whitish buff; the eyes are pale blueish-grey, and there is no appearance of a lax skin or longer hair beneath the throat. The females are smaller, and have similar horns to those of Asia.

In their manners they resemble the *O. Ammon*, living in troops of thirty to forty, headed by an old ram, bounding vigorously along the steepest ridges, and occasionally descending on the plain, particularly during the severest winter days. If the American species be the same as the Asiatic, which appears very probable, it can have reached the New World only over the ice by Behring's Straits; and the passage may be conjectured as comparatively of a recent date, since the argali has not spread eastward beyond the Rocky Mountains, nor to the south, further than California.

The *Bearded Argali.* (*O. Tragelaphus.*) Africa has its argali, and in all likelihood more than one variety of the species; for it does not appear that the specimen described by Dr Caius, and that discovered by Mr

resembles the ram in its horns, in all the particular contours of its form. The horns also are alike; they are of a yellow colour; they have three sides, as in the ram, and bend backwards in the same manner behind the ears; the muzzle and the inside of the ears are of a whitish colour, tinctured with yellow; the other parts of the face are of a brownish gray. The general colour of the hair over the body is of a brown, approaching to that of the red deer. The inside of the thighs and the belly are of a white, tinctured with yellow. The form, upon the whole, seems more made for agility and strength than that of the common sheep; and the moufflon is actually found to live in a savage state, and maintain itself, either by force or swiftness, against all the animals that live by rapine. Such is its extreme speed, that many have been inclined rather to rank it among the deer kind, than the sheep. But in this they are deceived, as the musmon has a mark that entirely distinguishes it from that species, being known never to shed its horns. In some these are seen to grow to a surprising size; many of them measuring, in their convolutions, above two ells long. They are of a yellow colour, as was said; but the older the animal grows, the darker the horns be-

---

Geoffroy St Hilaire in the mountains of Egypt, can be viewed otherwise than as varieties of the same species; that figured by Mr Pennant may be altogether distinct.

The tragelaphus, described by Caius about 1561, brought from the mountains of Mauritania, (Morocco?) was larger than a fallow-deer, or nearly equal to a stag, being three feet six inches at the shoulder, and four feet six from the nape of the neck to the tail. The head, from the nostrils to the vertex, one foot three inches; the horns one foot one inch and a half in circumference at base, one inch asunder on the head, bending back and downwards, angular, black, two feet one inch long, and wrinkled; the ears small; a beard formed by hairs on the cheeks, and under-jaw dividing into two lobes; the neck thick, of no great length, and beneath it a quantity of long hairs hanging from the throat to the knees; a setaceous mane stood up along the neck, and in particular about the withers, where it was tufted, long, and erect, and of the same colour, or somewhat darker than that of the rest of the body, which resembles the winter dress of a stag, or blackish-rufous; the knees, protected by long and dense hairs which seem intended to protect them in bounding, were bent backwards, but without a callosity; the legs were slender, and the external hoofs of the fore-feet longer than the internal; the incisors were only *six* in number; the nostrils black, divided by a perpendicular line of the same colour. It was gentle, petulant, and lascivious, fond of ascending high places and roofs of houses; it could run swiftly and bound prodigiously. According to Caius, the females are larger than the males, but are not provided with a similar luxuriant mane, but on this head he does not seem to speak from personal observation.

The Musmon. (*O. Musmon.*) The ancients were acquainted with this animal: Pliny notices the musmon, musimon and ophion. In Candia it is still said to be found. The mountaineers of Sardinia and Corsica are well acquainted with it, by the name of Mufro, and in former ages it abounded in Spain, and, probably, in all the high primitive chains of mountains in temperate Europe. If one species of ovis can make a direct claim to the progenitorship of the domestic breeds more than another, it would be the musmon, and the last described variety of Africa, which by the structure of its horns is more allied to musmon than to ammon; both having proved that the intermixture with domestic sheep is readily accomplished, and the intermediate breed prolific. It is probable that African sheep first peopled the south and west of Europe, perhaps as early as the Asiatic, which may have spread themselves over Greece, Sicily, and the east of Italy; but a later period may be assigned to those which came round the Black Sea into the valley of the Danube: the northern nations of wooded Europe could not maintain them till a period comparatively recent.

The Corsican musmon, like the African animal, has the horns shorter than the other argalis, usually not exceeding one and a half the length of the head, curved backwards, and the points turned inwards. In general the colour of the fur is a brownish or liver coloured gray, with more or less white upon the face and legs; there is also a tuft of long hair beneath the throat, and a darker streak along the back and on the flanks. But they sometimes vary in colour, being marked with large black spaces, particularly about the neck, resembling, in this particular, the domestic breeds both in Africa and India, which appear to be nearest the original stock. The females are in general without horns, and of all the wild species of the sheep, they have the chaffron most arched, and are said to be the least intelligent and hardy. Of the facility of breeding this species with our domestic sheep, proof was obtained from the specimen brought to England by the celebrated Pascal Paoli, which was the parent of a mixed progeny here; hence, there is some ground to suspect that the musmon and ophion of the ancients were not synonymous names for the same animal, and that the wild sheep of Spain and the Carpathian mountains are not the mufro of Corsica. The Spanish wild sheep mixed however with the domestic, and the intermediate breed, according to Pliny, were named umbri.

The musmons of Sardinia and Corsica never quit the highest ridges: where, however, the temperature allows no permanent snows. They live in small herds, headed by an old male, uniting occasionally into flocks of near one hundred; but they separate again in December and January, when the rutting season commences, and the usual battles have decided how many females each male can retain. The females yean two lambs in April and May, which run about the moment they are dropped, and are cherished and defended with great constancy by their dams: they are not adult till the third year, but the power of procreation is the same as in the domestic races, and can commence at eighteen months. In Corsica the male is denominated mufro, and the female mufra, from which Buffon has formed the word moufflon. Their skins are used for various purposes, and in that island and Sardinia, the mountaineers still convert them into vests, and a kind of cloaks, which may be the present representatives of the *Mastruca Sardorum*, noticed in the commentaries on Cicero, as made from the skin of the mufro; this dress was worn in particular by the inland robbers, the *Mastruci Latrunculi*.

It appears that in ancient times a wild species of sheep inhabited Great Britain. Boetius mentions a wild breed in St Kilda, larger than the biggest goat, with tails hanging to the ground, and horns longer and as bulky as those of an ox. Mr Pennant observes upon this subject, that such an animal is figured on a bas relief taken out of the wall of Antoninus near Glasgow.—*Supplement to the English Translation of Cuvier's Animal Kingdom, By Major Charles Hamilton Smith, F.R.S. and L.S. &c.*

come: with these they often maintain very furious battles between each other; and sometimes they are found broken off in such a manner, that the small animals of the forest creep into the cavity for shelter.[1] When the musmon is seen standing on the plain, his fore-legs are always straight, while his hinder legs seem bent under him; but in cases of more active necessity, this seeming deformity is removed, and he moves with great swiftness and agility. The female very much resembles the male of this species, but that she is less, and her horns also are never seen to grow to that prodigious size they are of in the wild ram. Such is the sheep in its savage state; a bold, noble, and even beautiful animal: but it is not the most beautiful creatures that are always found most useful to man. Human industry has therefore destroyed its grace, to improve its utility.

THE GOAT,[2]

AND ITS NUMEROUS VARIETIES.

There are some domestic animals that seem as auxiliaries to the more useful sorts; and that, by ceasing to be the first, are considered as nothing. We have seen the services of the ass slighted, because inferior to those of the horse; and in the same manner, those of the goat are held cheap, because the sheep so far exceeds it. Were the horse or the sheep

---

[1] Gmelin, as quoted by Buffon.

[2] The *goat* is a native of many mountainous parts of Europe, Africa, Persia, and India: he is domesticated throughout Europe, feeds on branches of shrubs, on lichens, hemlock, &c.; is seldom destitute of horns, of active habits like the deer, treacherous, petulant, roaming, and lascivious; gravid four months and a half, brings from one to two at a birth, and lives ten or twelve years. The female will allow itself to be sucked by the young of various other animals; and a foal which has lost its mother has been seen thus nourished by a goat, which, in order to facilitate the process, was placed on a barrel. The attachment between the nurse and foal appeared strong and natural. In its internal structure, it extremely resembles sheep, but is far superior to them in alertness, sentiment, and intelligence. The goat approaches man without difficulty, is won by kindness, and capable of attachment. The extremely unpleasant odour attending these animals is supposed to be beneficial, and horses appear so much refreshed by it, that a goat is, on this account, often kept in the stables of the great.

The Angora goat, a native of Turkey, is chiefly valued for its exquisitely fine hair down, which grows under its coarse hair, and of which the Cashmere shawls are manufactured. The down is obtained by gently combing them. A considerable number of this breed were imported into France from Persia, in 1819, and stationed at St Omers, with a view to their increase, and the establishment of the shawl manufacture. The kids of this flock are said to be abundantly covered with down and hair, and superior in strength and appearance to indigenous French kids of the same age. It is a common opinion, that the down of this goat degenerates when the animals are removed from the pasturage of Angora; but this is likely in part to arise from the neglect of cleaning and washing them, which at Angora is so assiduously attended to. By a late Report of M. Terneaux to the Paris Agricultural Society, the French Angoras have increased in number, and prosper equally with the native variety.

The Syrian goat is remarkable for its pendulous ears, and is common throughout the East, in Egypt, and on the coast of Africa. It has likewise been introduced into Sicily, but can only be kept in health in very warm situations.

The Chamois goat, a native of Switzerland, is a species of antelope, and is described under that head.

The goats of Wales are generally white, and are both stronger and larger than those of other hilly countries. Their flesh is much used by the inhabitants, and often dried and salted, and substituted for bacon. The skins of the kids are much valued for gloves, and were formerly employed in furniture, when painted with rich colours, of which they are particularly capable, and embellished with ornamental flowers, and works of silver and gold. The goat may be of some advantage in rocky barren countries, where nothing else can get a support for life. They will climb the steepest rocks, and there browse upon briers, heath, and shrubs of various kinds, which other creatures will not taste of. They will feed on grass in pastures; but, as they love browsing on trees much better, great care should be taken to keep them from valuable plantations. (See Plate XIV. fig. 14.)

The produce of the goat, from which advantage is chiefly obtained, is the milk, which it yields in large quantities, and which is accounted the best milk of all animals. They mix this and cows' milk together in some parts of the kingdom, and a very valuable cheese is made from it. Besides this, the kids or young goats are very fine food, and the best kinds bring forth two or three at a time, and that twice a year. Goat's hair is also valuable; it may be sheared as the wool from sheep, and is excellent for making ropes that are to be used in the water, as they will last a great while longer than those made in the common way. A sort of stuff is also made of it in some places. The suet of the goat is also in great esteem, and many of the inhabitants of Caernarvonshire kill them merely for the sake of their fat, which makes candles of a superior quality to the common. Of their horns excellent handles are made for tucks and penknives. The skin is peculiarly well adapted for the glove manufactory, especially that of the kid, as it takes a dye better than any other skin. The old skin is also of great use, being preferred to that of the sheep, and the flesh affords a cheap and plentiful provision in the winter months, particularly when the kids are brought to market. The haunches of the goat are frequently salted and dried, and supply all the uses of bacon: this by the Welsh is called *coch yr wden*, or hung venison.

The kind of goats for keeping to advantage should be chosen in this manner:—The male should have a large body, his hair should be long, and his legs straight and stiff; the neck should be plain and short, the head small and slender, the horns large, the eyes prominent, and the beard long. The female should have a large udder, with large teats, and no horns, or very small ones. Goats should be kept in flocks, that they may not straggle; and they should have good shelter both in summer and in winter, the heat and cold being both prejudicial to them, and coupled in December. They should have no litter in winter, but only a paved floor kept clean. The kids are to be brought up for the table in the same manner as our lambs are.

The Cashmere shawl goat has been successfully intro-removed from nature, the inferior kinds would then be invaluable; and the same arts would probably be bestowed in perfecting their kinds, that the higher order of animals have experienced. But in their present neglected state, they vary but little from the wild animals of the same kind: man has left them in their primitive habits and forms; and the less they owe to his assiduity, the more they receive from nature.[1]

The goat seems, in every respect, more fitted for a life of savage liberty than the sheep. It is naturally more lively, and more possessed with animal instinct. It easily attaches itself to man, and seems sensible of his caresses. It is also stronger and swifter, more courageous and more playful, lively, capricious, and vagrant: it is not easily confined to its flock, but chooses its own pastures, and loves to stray remote from the rest. It chiefly delights in climbing precipices, in going to the very edge of danger; it is often seen suspended upon an eminence hanging over the sea, upon a very little base; and even sleeps there in security. Nature has in some measure fitted it for traversing these declivities with ease; the hoof is hollow underneath, with sharp edges, so that it walks as securely on the ridge of a house, as on the level ground. It is a hardy animal, and very easily sustained; for which reason it is chiefly the property of the poor, who have no pastures with which to supply it. Happily, however, it seems better pleased with the neglected wild, than the cultivated fields of art; it chooses the heathy mountain, or the shrubby rock; its favourite food is the tops of boughs, or the tender bark of young trees; it seems less afraid of immoderate heat, and bears the warm climates better than the sheep; it sleeps exposed to the sun, and seems to enjoy its warmest fervours, neither is it terrified at the storm, or incommoded by the rain; immoderate cold alone seems to affect it, and is said to produce a vertigo, with which this animal is sometimes incommoded. The inconstancy of its nature is perceivable in the irregularity of its gait; it goes forward, stops, runs, approaches, flies, merely from caprice, and with no other seeming reason than the extreme vivacity of its disposition.

There are proofs of this animal's being naturally the friend of man; and that the goat seldom resumes its primeval wildness, when once reduced into a state of servitude.[2] In the year 1698, an English vessel, happening

---

duced into England, by C. T. Tower, Esq. of Weald Hall, Essex. This variety of the common goat, or probably it may be a distinct species, is a fine-looking animal, and would be very ornamental in a park, on a ruin, on the roof of a cottage, or in a churchyard. It would also be very pleasant to have a home-made Cashmere shawl. We shall therefore give all the information we can on the subject from Mr Tower's account, as published in the xlvi. volume of the Transactions of the Society of Arts. The Cashmere goat was brought from Persia, to France during the time of Napoleon, and under his patronage, by the celebrated M. Terneaux, in 1828. Mr Tower, happening at that time to be in Paris, purchased four of them, two males and two females, and succeeded in conveying them safely to his residence in Essex. The soil of the park at Weald Hall, where they have been kept ever since, is moist, and the situation is much exposed. The animals have, nevertheless, continued in health and multiplied rapidly; so that his present flock consists of twenty-seven, including the four original ones. Of these latter a polled female, which was old when purchased by him, has every year produced at least one kid, and has twice had twins. Those individuals of which the horns cross are in Persia esteemed the best; and one of Mr Tower's last year's kids has this peculiarity. They show no impatience of cold, and are very healthy, requiring only the occasional shelter of a shed, in very rough weather. In spring, summer, and autumn, they graze like sheep; and during winter have been fed with hay, and refuse vegetables from the garden; but their favourite food is gorse, which they devour eagerly, without being annoyed by its prickles. They damage young plantations, but not more than other goats or deer will do. They breed very early; three of Mr Tower's goats this year produced kids before they were themselves a twelvemonth old. A few produce brown wool; but that of far the greater proportion of the goats is white, and this latter is more valuable than the other. The coat is a mixture of long coarse hair, and of short fine wool: this latter begins to be loose early in April; and is collected easily and expeditiously by combing the animals two or three times, with such a comb as is used for horses' manes. A good deal of the long hair comes off at the same time, but the manufacturer has found no difficulty in separating it. The produce of a male is about four ounces, and of a female about two ounces. Two pounds of wool as it comes off the goat's back may be estimated to make one shawl, fifty four inches square. It will therefore require ten goats, male and female, to furnish materials for one shawl. Mr Tower has this year had three shawls made of his wool, one of which was examined by the committee of manufacturers. The yarn was spun by Messrs. Pease, of Darlington, and was woven by Messrs. Miller and Sons, of Paisley. Mr Tower's shawl was compared with one made in Scotland, of French shawl-goat wool, to which it was evidently far superior. It was also compared with a shawl of M. Terneaux's own make; and was considered by very competent judges to be superior to this also.

[1] Buffon.

[2] "Upon our road," (from Jerusalem to Bethlehem,) says Dr Clarke, in his Travels, "we met an Arab with a goat, which he led about the country for exhibition, in order to gain a livelihood for itself and owner. He had taught this animal, while he accompanied its movements with a song, to mount upon little cylindrical blocks of wood, placed successively one above the

to touch at the island of Bonivista, two negroes came and offered the sailors as many goats as they chose to take away. Upon the captain's expressing his astonishment at this offer, the negroes assured him that there were but twelve persons on the island, and that the goats were multiplied in such a manner as even to become a nuisance: they added, that instead of giving any trouble to catch them, they followed the few inhabitants that were left with a sort of obstinacy, and rather became importunate with their tameness.

The goat produces but two at a time, and three at the most. But in the warmer climates, although the animal degenerates, and grows less, yet it becomes more fruitful, being generally found to bring forth three, four, and five, at a single delivery. The buck is capable of propagating at the age of one year, and the female at seven months; however, the fruits of this premature generation are weak and defective; and their best breeding-time is generally delayed till the age of two years or eighteen months at least. One buck is sufficient for a hundred and fifty goats; his appetites are excessive; but this ardour brings on a speedy decay, so that he is enervated at four years at most, and even becomes old before he reaches his seventh year. The goat, like the sheep, continues five months with young; and in some places bears twice a year.

The milk of the goat is sweet, nourishing, and medicinal;[1] not so apt to curdle upon the stomach as that of the cow; and, therefore, preferable to those whose digestion is but weak. The peculiarity of this animal's food gives the milk a flavour different from that either of the cow or the sheep; for as it generally feeds upon shrubby pastures, and heathy mountains, there is an agreeable mildness in the taste, very pleasing to such as are fond of that aliment. In several parts of Ireland and the highlands of Scotland, the goat makes the chief possession of the inhabitants. On those mountains, where no other useful animal could find subsistence, the goat continues to glean a sufficient living, and supplies the hardy natives with what they consider as varied luxury. They lie upon beds made of their skins, which are soft, clean, and wholesome; they live upon their milk with oat-bread; they convert a part of it into butter, and some into cheese: the flesh, indeed, they seldom taste of, as it is a delicacy, which they find too expensive; however, the kid is considered, even by the city epicure, as a great rarity; and the flesh of the goat, when properly prepared, is ranked by some as no way inferior to venison. In this manner, even in the wildest solitudes, the poor find comforts of which the rich do not think it worth their while to dispossess them: in these mountainous retreats, where the landscape presents only a scene of rocks, heaths, and shrubs, that speak the wretchedness of the soil, these simple people have their feasts and their pleasures; their faithful flock of goats attends them to these awful solitudes, and furnishes them with all the necessaries of life; while their remote situation happily keeps them ignorant of greater luxury.

As these animals are apt to stray from the flock, no man can attend above fifty of them at a time. They are fattened in the same manner as sheep; but taking every precaution, their flesh is never so good, or so sweet in our climate, as that of mutton. It is otherwise between the tropics. The mutton there becomes flabby and lean, while the flesh of the goat rather seems to improve; and in some places the latter is cultivated in preference to the former. We, therefore, find this animal in almost every part of the world, as it seems fitted for the necessities of man in both extremes. Towards the north, where the pasture is coarse and barren, the goat is fitted to find a scanty subsistence; between the tropics, where the heat is excessive, the goat is fitted to bear the climate, and its flesh is found to improve.

One of the most remarkable varieties we find in the goat is in that of Natolia. The Natolian goat, or, as Mr Buffon calls it, the goat of *Angora*, has the ears longer than ours and broader in proportion. The male has horns of about

---

other, and in shape resembling the dice-boxes belonging to a back-gammon table. In this manner the goat stood, first upon the top of one cylinder, then upon the top of two, and afterwards of three, four, five, and six, until it remained balanced upon the top of them all, elevated several feet from the ground, and with its *four feet* collected upon a single point without throwing down the disjointed fabric upon which it stood. The practice is very ancient. It is also noticed by Sandys. . Nothing can show more strikingly the tenacious footing possessed by this quadruped upon the jutty points and crags of rocks; and the circumstance of its ability to remain thus poised may render its appearance less surprising, as it is sometimes seen in the Alps, and in all mountainous countries, with hardly any place for its feet, upon the sides and by the brink of most tremendous precipices. The diameter of the upper cylinder, on which its feet ultimately remained until the Arab had ended his ditty, was only two inches, and the length of each cylinder was six inches."

[1] I believe the best method of rearing children, when their mothers cannot nurse them, is by allowing them to suck a domesticated animal. I know a fine healthy young lady, now about seventeen years of age, who was thus reared. A goat is the best animal for this purpose, being easily domesticated, very docile, and disposed to an attachment for its foster child: the animal lies down, and the child soon knows it well, and when able, makes great efforts to creep away to it and suck. Abroad the goat is much used for this purpose; the inhabitants of some villages take in children to nurse; the goats, when called, trot away to the house; and each one goes to its child, who sucks with eagerness, and the children thrive amazingly.—*Gooch's Lectures.*

the same length with the goat of Europe, but black, and turned very differently, going out horizontally on each side of the head, and twisted round in the manner of a cork-screw. The horns of the female are shorter, and encircle the ear, somewhat like those of the ram. They are of a dazzling white colour, and in all the hair is very long, thick, fine, and glossy; which indeed is the case with almost all the animals of Syria. There are a great number of these animals about Angora, where the inhabitants drive a trade with their hair, which is sold either raw, or manufactured, into all parts of Europe. Nothing can exceed the beauty of the stuffs which are made from the hair of almost all the animals of that country. These are well known among us by the name of *camlet*.

A second variety is the Assyrian goat, of Gesner, which is somewhat larger than ours, with ears almost hanging down to the ground, and broad in proportion.[1] The horns, on the contrary, are not above two inches and a half long, black, and bending a little backwards. The hair is of a fox colour, and under the throat there are two excrescences, much like the gills of a cock. These animals are chiefly kept round Aleppo for the sake of their milk. They are driven through the streets, and their milk is sold to the inhabitants as they pass along.

In the third variety may be reckoned the little goat of Africa, which is of the size of a kid, but the hair is as long as that of the ordinary breed. The horns, which do not exceed the length of a man's finger, are thick, and bend downwards so close to the head that they almost enter the skin.

There is an animal of this kind at the Cape of Good Hope, called the *blue goat*, which may be ranked as the fourth variety. It is in shape like the domestic, but much larger, being nearly of the size of a stag. Its hair is very short, and of a delightful blue; but it loses a great deal of its beauty when the animal is dead. It has a very long beard; but the horns are not so long in proportion as in other goats, being turned spirally, in the manner of a cork-screw. It has very long legs, but well proportioned, and the flesh is very well tasted, but lean. For this reason, in that plentiful country it is chiefly killed upon account of its skin. It is a very shy animal, and seldom comes near the Dutch settlements; but they are found in great abundance in the more uncultivated parts of the country. Besides these, they are found in this extensive region of various colours, and many of them are spotted beautifully, with red, white, and brown.[2]

In fine, the Juda goat resembles ours in most parts except in size, it being much smaller. This animal is common in Guinea, Angola, and all along the coast of Africa; it is not much larger than a hare, but it is extremely fat, and its flesh admirably tasted. It is in that country universally preferred to mutton.

These animals seem all of one kind, with very trifling distinctions between them. It is true that they differ in some respects; such as having neither the same colour, hair, ears, or horns. But it ought to be considered as a rule in natural history, that neither the horns, the colour, the fineness or the length of the hair, or the position of the ears, are to be considered as making an actual distinction in the kinds. These are accidental varieties produced by climate and food, which are known to change even in the same animal, and give it a seeming difference of form. When we see the shapes, the inclinations, and the internal conformation of seemingly different creatures nearly the same; and, above all, when we see them producing among each other, we then have no hesitation in pronouncing the species, and asserting that these are of the goat kind, with which they are so materially connected.

But although these are evidently known to belong to the goat kind, there are others nearly resembling the goat, of whose kindred we cannot be equally certain. These are such as, being found in a state of nature, have not as yet been sufficiently subjected to human observation. Hence it is impossible to determine with precision to which class they belong; whether they be animals of a particular kind, or merely the goat in its state of savage freedom. Were there but one of these wild animals, the inquiry would soon be ended, and we might readily allow it for the parent stock; but, in the present case, there are two kinds that have almost equal pretensions to this honour; and the claims of which it has been found difficult to determine. The animals in question are the chamois and the ibex. These both bear very near approaches to the goat in figure; have horns that never shed; and, at the same time, are more different from each other than from the animal in question. From which of these two sources our domestic goat is derived is not easy to settle. Instead, therefore, of entering into the discussion, I will content myself with the result of Mr Buffon's inquiries. He is of opinion that the ibex is the principal source; that our domestic goat is the immediate descendant: and that the chamois is but a variety from that stock, a sort of collateral branch of the same family. His principal reason for giving the preference to the ibex is, its having a more masculine figure, large horns, and a large beard; whereas the chamois wants these marks of primitive strength and wildness. He supposes, therefore, in their original savage state, that our goat has taken after the male of the parent stock, and the chamois after the female: and that this has produced a variety in these animals even before they underwent human cultivation.

---

[1] M. Sonini assures us, that though the ears of this variety are much longer than those of the common goat, they never reach so low as the ground, nor, as has been reported, are they ever cropped.

[2] This species is now known to be of the antelope tribe, and is, by all modern zoological writers, called the blue antelope.

However this be, the two animals in question seem both well fitted for their precarious life, being extremely swift, and capable of running with ease along the ledges of precipices, where even the wolf or the fox, though instigated by hunger, dares not pursue them. They are both natives of the Alps, the Pyrenees, and the mountains of Greece; there they propagate in vast numbers, and continue to exist in spite of the hunter and every beast of prey that is found incessantly to pursue them.

The ibex resembles the goat in the shape of its body; but differs in the horns, which are much larger.[1] They are bent backward, full of knots; and it is generally asserted that there is a knot added every year. There are some of these found, if we may believe Bellonius, at least two yards in length. The

---

[1] The *Ibex* is an animal near five feet long, two feet eight inches in height at the shoulder, with about two

inches more at the rump; the horns are flat, sustained by two longitudinal ridges at the sides, traversed by numerous cross ridges or knots, disposed at intervals so as to bear a resemblance, when seen in front, to a segment of a cog-wheel; they are nearly vertical to the plane of the face at their roots, diverging and uniformly falcated backwards, sometimes thirty inches long, dark coloured, and very robust. It is asserted that the transverse knots mark their age. In the first years the ibex is of a light ashy-gray colour, deepening to brown as it advances in age, and in the adult varies from a red-brown in summer, to a gray-brown in winter; the hair is never very long or loose; on the face, and along the back, is a line of a dark colour; the internal face of the thighs and buttocks are whitish; the inside of the ears and inferior part of the tail are white; the head under the chin is short, dark-brown, and not very full. An adult female, which was shot in the mountains of Asturias, in Spain, had horns much resembling those of the male in his third year, but more slender, less curved, and marked with four knots on the anterior side; the forehead, sternum, anterior face of the legs, and the pasterns, were earthy brown; the neck and back gray-brown, paler beneath. The ibex ruts in autumn; the male then emitting a most powerful smell, assembles the females, and remains with them till the spring; when the females begin to withdraw into cover, for the purposes of parturition, which takes place in one hundred and sixty days after impregnation, usually in April; the kids following the mother in a few hours after their birth.

The species seems to be confined to the highest mountains of Europe, the Alps, particularly the Rhœtian, and the Pyrenees, with their loftiest branches. They may exist still in those of Candia, Greece, and the Carpathian, but it is doubtful whether the variety noticed by Pallas in the Caucasian range was decidedly of the same species. They prefer the most elevated ridges, upon and near the verge of perpetual snow, which they invariably seek when pursued. In Savoy and Switzerland they are now rarer than in the Tyrol, and in the Pyrenees they are nearly extinct.

The *Abyssinian Ibex* is somewhat more elevated on the legs than the European, of a dirty brownish fawn colour, with a short beard, and lengthened hair under the throat down to the breast, and a darkish line on the anterior part of the legs, and along the back; the ears appear shorter, but the horns, of a dirty colour, are superior in length to those of the ibex, forming a half circle, closer on the forehead, less diverging backwards; they are subtriangular, having a round edge to the front, marked in one pair with twenty-three very elevated cross ridges, extending to near the posterior edge, and rather irregular in their distances; besides these, four other less prominent appear near the base, and from the thirteenth the larger knots are separated by three smaller. This species, we are told, is numerous in the mountains of Abyssinia and of Upper Egypt.

The *Caucasian Ibex*. M. F. Cuvier distinguishes this species from the Ægagrus "by the horns being triangular, the anterior face forming an angle, with ribs or projecting knots." This definition would apply to the Abyssinian; it is therefore necessary to add, that the knots are progressively more distant from each other as they recede from the base, with uniform transverse wrinkles, not so prominent, confused, and crowded, as in the former. M. Guldenstadt first described the species, which he discovered in the northern part of the Caucasian mountains. In size and proportions it resembles the ibex of Europe, but is broader and shorter in the body; dark brown on the superior parts, and white on the inferior; the head is gray, excepting a space round the mouth, which is black; the breast, and a line along the back, are dark, and there is a white streak at the back of the shanks; the under jaw and gullet are generally whitish-gray, and the anterior part of the legs is dark; the horns are about twenty-eight inches long, dark brown, and very solid. The hair of this species is rather hard, more ashy in winter, and at the root interspersed with much grayish underwool. The females are smaller, with diminished horns, as in the former. This species of ibex is equal, if not superior, in strength and agility to the Alpine, making immense bounds with the utmost confidence. Monardes relates that he saw an ibex leap from the top of a tower, and falling on its horns, immediately spring up and move on without having received the slightest injury. It resides in the Caucasian mountains about the sources of the Terek and Cuban, and is probably found in the high mountains of eastern Persia.

The *Ægagrus*. (*C. Ægagrus*.) This species is distinguished from the former by the horns forming an acute angle to the front, with the ribs less broad, assumibex has a large black beard, is of a brown colour, with a thick warm coat of hair. A streak of black runs along the top of the back; and the belly and back of the thighs are of a fawn colour.

ANIMALS OF THE ANTELOPE KIND.[1]

The chamois,[2] (see plate XIV. fig. 15.) though a wild animal, is very easily tamed, and docile; and to be found only in rocky and mountainous places. It is about the size of a domestic goat, and resembles one in many respects. It is most agreeably lively, and active beyond expression. The chamois hair is short, like that of the doe; in spring, it is of an a colour; in autumn, a dun colour, inclining black; and in winter, of a blackish brown. T animal is found in great plenty in the mou tains of Dauphiny, of Piedmont, Savoy, Sw zerland, and Germany. They are peacefu gentle creatures, and live in society with eac other. They are found in flocks of from fou to fourscore, and even a hundred, disperse upon the crags of the mountains. The large males are seen feeding detached from the rest, except in rutting time, when they approach the females, and drive away the young. The time of their coupling is from the beginning of October to the end of November; and they

---

ing an undulating edge, and the posterior part rounded. In size and proportion it is nearly the same as the ibex; the fur is grayish-brown above, with a dark line on the back, and a black tail; the head black about the nose, rufous at the sides; beard and throat brown; the horns are near three feet long, but in the females they are small, or altogether wanting: their fur is paler and more uniform in colour. Kæmpfer noticed the bezoar-bearing goat by the name of Paseng, which Buffon, by mistake, transferred to an Oryx; and it is very probable that the antelopes, as well as other ruminants, occasionally produce the concretions. That the oriental bezoar was extracted chiefly from the viscera of the present species at a very early period, appears indicated in a bas relief at Chelminar or Persepolis, which represents a man leading a wild goat by the horns in token of tribute to the great king. Kæmpfer, Gmelin, and others, notice the Ægagrus as found in the Caucasian mountains, the hills of Laar and Chorazan in Persia, and in still greater abundance in Asia Minor. Pallas first clearly distinguished it from its congeners, and conjectured that the domestic goats might derive from this stock.

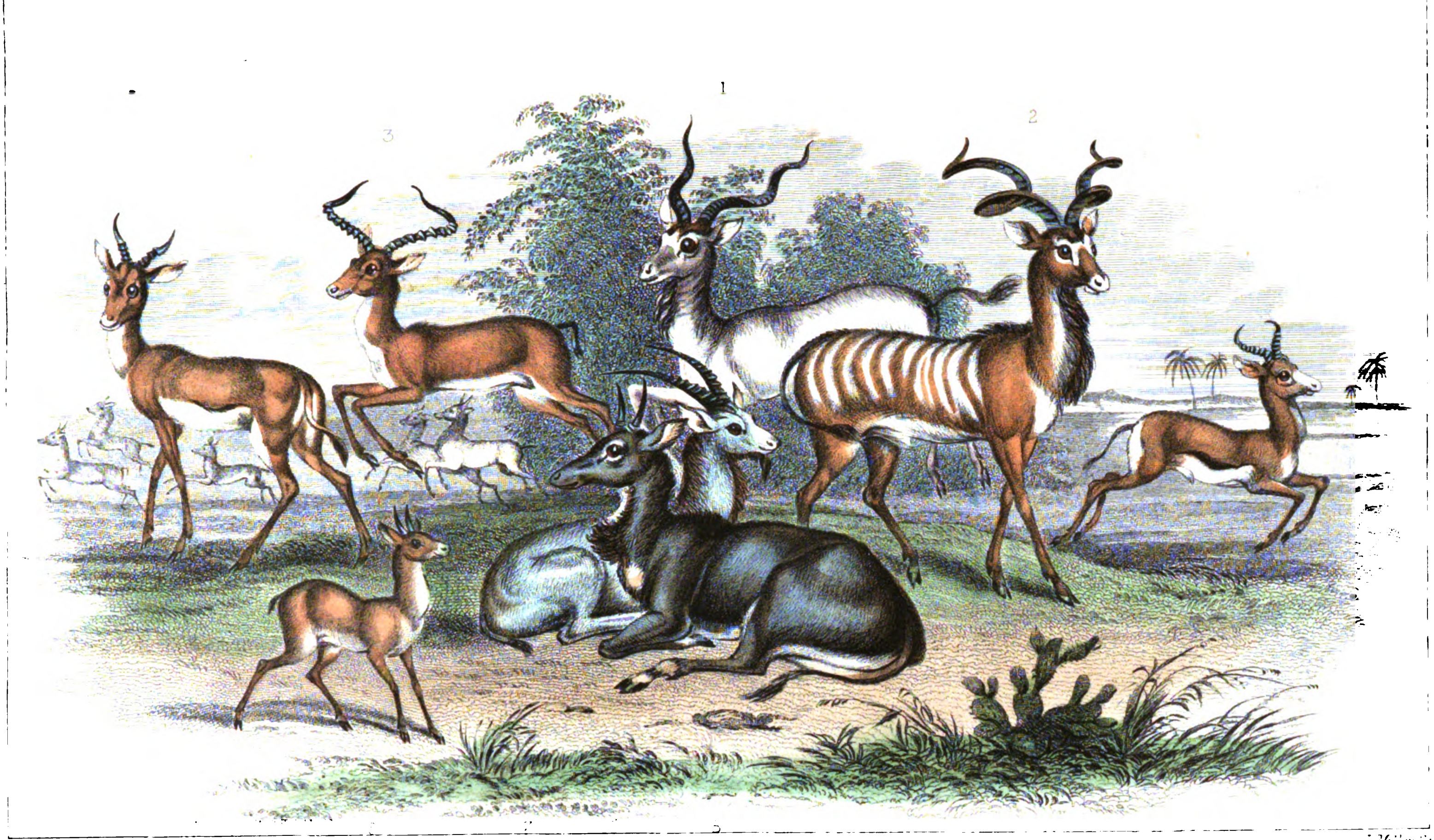
[1] The chamois and gazelles described in the following pages, constitute mere species of the numerous tribe of ANTELOPES, a genus which has now obtained among naturalists a rank for themselves. This genus forms the head of the Caprine tribe, according to Cuvier, because its subordinate groups display almost invariably cervine proportions in the elegance of their conformation.

The groups of the antelope species with spiral and lyrated horns are mostly gregarious, frequenting the open plains, and often preferring the most barren tracts; the larger species, however, more usually live in families or small troops, on the desert or in mountainous woods, and the smallest are not unfrequently solitary or monogamous, residing in the thickets, the forest, or the borders of rivers; while there are others whose habitation is confined to mountainous regions, inaccessible crags, and even to the elevated zones on the confines of perpetual snow. These walk with perfect composure along the giddy brinks of the most awful precipices, climb and descend with wonderful care and precision, and leap down or up to the smallest surface that will contain their collected feet with perfect firmness; but the speed of those who frequent the plains, and more particularly of the swiftest species, consists in the alternate action of three or four strokes of a gallop, terminated by a long bound, repeated in constant succession and producing a beautiful effect: of others it is an uniform stretch termed running. Though vigilant and timid by nature, the gregarious species have the same curiosity which deer and sheep evince at the sight of strange objects; flying with prodigious speed, then stopping and turning to gaze. Their voice is mostly weak, and seldom heard: it consists in some of a feeble bleeting, in others it is a groaning or whistling sound, and there is one which barks so as to deceive the unwary traveller into a belief that he is near the abode of man, when in fact it is the proof of his being benighted in the deepest recesses of the wood.

In a wild state it seems that each species feeds on a few favourite plants; they pick rather than browse: some, like several species of deer, nibble the leaves of trees, acacias, mimosas, and shrubs. The gregarious keeping on the open plains, select grasses and their roots, heaths, wild tritica, and are not averse to bitter succulents and intoxicating plants, being even attracted by the smoke of tobacco. There is a disposition in several species to dung in one place, which arises probably from the extreme delicacy of their sense of smelling. In general their venison is lean, and savours of a musky smell; but the flesh of others is praised, and all afford the usual meal to the larger nocturnal carnivora, and even to the eagle. The females, particularly of the gregarious species, are gentle and confident when reduced to domesticity, but the males, at least in the rutting season, are vicious and subject to sudden capricious fits. The beauty of their soft and large dark eyes, has long been the theme of Arabian and Persian poetical enthusiasm. The very name gazelle, by which several of the genus are designated, is also in Arabic an image of peculiarly tender and delicate women; it is likewise applied to a species of stanza of highly polished and tender versification; the root, however, seems taken from the Hindu Sasi or Sasin, the name of the common antelope. It appears that in the beautiful regions of the East, beyond the river Indus, these animals have attracted the notice of mankind in an extraordinary degree, even in the primitive ages of that land of early civilization; for we find them in the oldest mythologies, and among the symbols of its astronomy. The fleetness of the antelope was proverbial even in the earliest times: the speed of Asahel (2d Samuel ii. 18.) is beautifully compared to that of the zebi, and the Gadites were said to be as swift as the antelopes upon the mountains. The sacred writers took their similes from such objects as were before the eyes of the people to whom they addressed themselves. There is another instance drawn from the same subject: the disciple raised to life at Joppa was supposed to have been called Tabitha, i. e. Dorcas, or the antelope, from the beauty of her eyes. And to this day one of the highest compliments that can be paid to female beauty in the eastern regions is, *Aine el lezoxcl*, "You have the eyes of an antelope."

Of the very numerous species of the genus Antelope, it would be almost impossible to give a complete and distinct description. The more remarkable of them will be found noticed in the text, under the head of Gazelles, and in the notes appended to that section.

[2] M. Peroud's Account, as quoted by Buffon.



J. Stewart Del.

ANTELOPES. (1. ADDAX. 2. KOODOO. 3. PALLAH. 4. KEVEL GAZELLE. 5. SPRINGBOCK.
(6. SALT'S ANTELOPE. 7. TAKHAITZE. 8. NYL GHAU.

[illegible]

bring forth in March and April. The young keeps with the dam about five months, and sometimes longer, if the hunters and the wolves do not separate them. It is asserted that they live between twenty and thirty years. Their flesh is good to eat; and they are found to have ten or twelve pounds of suet, which far surpasses that of the goat in hardness and goodness. The chamois has scarcely any cry, as most animals are known to have; if it has any it is a kind of feeble bleat, by which the parent calls its young. But in cases of danger, and when it is to warn the rest of the flock, it uses a hissing noise, which is heard at a great distance. For it is to be observed, that this creature is extremely vigilant, and has an eye the quickest and most piercing in nature. Its smell also is not less distinguishing. When it sees its enemy distinctly, it stops for a moment, and then, if the person be near, in an instant after it flies off. In the same manner, by its smell, it can discover a man at half a league distance, and gives the earliest notice. Upon any alarm, therefore, or any apprehension of danger, the chamois begins his hissing note with such force, that the rocks and the forests re-echo to the sound. The first hiss continues as long as the time of one inspiration. In the beginning it is very sharp, and deeper towards the close. The animal having, after this first alarm, reposed a moment, again looks round, and perceiving the reality of its fears, continues to hiss by intervals, until it has spread the alarm to a very great distance. During this time, it seems in the most violent agitation; it strikes the ground with its forefoot, and sometimes with both; it bounds from rock to rock; it turns and looks round; it runs to the edge of the precipice, and, still perceiving the enemy, flies with all its speed. The hissing of the male is much louder and sharper than that of the female; it is performed through the nose; and is properly no more than a very strong breath driven violently through a small aperture. The chamois feeds upon the best herbage, and chooses the most delicate parts of the plants, the flower, and the tender buds. It is not less delicate with regard to several aromatic herbs which grow upon the sides of the mountains. It drinks but very little while it feeds upon the succulent herbage, and chews the cud in the intervals of feeding. This animal is greatly admired for the beauty of its eyes, which are round and sparkling, and which mark the warmth of its constitution. Its head is furnished with two small horns, of about half a foot long, of a beautiful black, and rising from the forehead, almost betwixt the eyes. These, contrary to what they are found in other animals, instead of going backwards or sideways, jet out forward, and bend a little, at their extremities, backward, in a small circle, and end in a very sharp point. The ears are placed, in a very elegant manner, near the horns; and there are two stripes of black on each side of the face, the rest being of a whitish yellow, which never changes. The horn of this animal is often used as the head of a cane. Those of the female are less, and not so much bent; and some farriers are seen to bleed cattle with them. These animals are so much incommoded by heat, that they are never found in summer, except in the caverns of rocks, amidst fragments of unmelted ice, under the shade of high and spreading trees, or of rough and hanging precipices, that face the north, and which keep off entirely the rays of the sun. They go to pasture both morning and evening, and seldom during the heat of the day. They run along the rocks with great ease and seeming indifference, and leap from one to another, so that no dogs are able to pursue them. There is nothing more extraordinary than to see them climbing and descending precipices, that to all other quadrupeds are inaccessible. They always mount or descend in an oblique direction and throw themselves down a rock of thirty feet, and light with great security upon some excrescence or fragment, on the side of the precipice, which is just large enough to place their feet upon; they strike the rock, however, in their descent, with their feet, three or four times, to stop the velocity of their motion; and, when they have got upon their base below, they at once seem fixed and secure. In fact, to see them jump in this manner, they seem rather to have wings than legs: some, indeed, pretend to say, that they use their horns for climbing; but this wants confirmation. Certain it is that their legs alone are formed for this arduous employment, the hinder being rather longer than the former, and bending in such a manner, that when they descend upon them, they break the force of the fall. It is also asserted, that when they feed, one of them always stands as centinel; but how far this may be true is questionable. For certain, while they feed there are some of them that keep continually gazing round the rest; but this is practised among all gregarious animals; so that when they see any danger, they warn the rest of the herd of its approach. During the rigours of winter, the chamois sleeps in the thicker forests, and feeds upon the shrubs and the buds of the pine tree. It sometimes turns up the snow with its foot to look for herbage, and where it is green makes a delicious repast. The more craggy and uneven the forest, the more this animal is pleased with the abode, which thus adds to its security. The hunting the chamois is very laborious, and extremely difficult.[1] The most usual way is to hide behind the clefts of the rocks, and shoot them. This however must be done with great precaution; the sportsman must creep for a vast way upon his belly in silence, and take also the advantage of the wind, which if it blow from him they would instantly perceive. When arrived at a proper distance, he then advances his piece, which is to be rifle-barrelled, and to carry one ball, and tries his fortune among them. Some also pursue this animal, as they do the stag, by placing proper persons at all the passages of a glade or valley, and then sending in others to rouse the game. Dogs are quite useless in this chase, as they rather alarm than overtake. Nor is it without danger, even to the men, for it often happens that when the animal finds itself overpressed it drives at the hunter with its head, and often tumbles him down the neighbouring precipice. This animal cannot go upon ice when smooth; but if there be the least inequalities on its surface, it then bounds along in security, and quickly evades all pursuit.

---

[1] The chamois hunters of the Alps are remarkable examples of what man may accomplish by courage, perseverance, and constant experiment. If he fairly bring his physical powers, and his mechanical aids, into a contest even with such surprising faculties as the chamois possesses, the triumph is his; and this triumph shows us that there are few things beyond the reach of human energy.

The chamois hunter sets out upon his expedition of fatigue and danger generally in the night. His object is to find himself at the break of day in the most elevated pastures, where the chamois comes to feed before the flock shall have arrived there. The chamois feeds only at morning and evening. When the hunter has nearly reached the spot where he expects to find his prey, he reconnoitres with a telescope. If he finds not the chamois, he mounts still higher;—but if he discovers him, he endeavours to climb above him, and to get nearer, by passing round some ravine, or gliding behind some eminence or rock. When he is near enough to distinguish the horns of the animal (which are small, round, pointed, and bent backward like a hook,) he rests his rifle upon a rock, and takes his aim with great coolness. He rarely misses. This rifle is often double-barrelled. If the chamois falls, he runs to his prey—makes sure of him by cutting the ham-strings—and applies himself to consider by what way he may best regain his village. If the route is very difficult, he contents himself with skinning the chamois;—but if the way is at all practicable with a load, he throws the animal over his shoulder, and bears it home to his family, undaunted by the distance he has to go, and the precipices he has to cross. But when, as is more frequently the case, the vigilant animal perceives the hunter, he flies with the greatest swiftness into the glaciers, leaping with incredible speed over the frozen snows and pointed rocks. It is particularly difficult to approach the chamois when there are many together. While the herd graze, one of them is planted as a sentinel on the point of some rock which commands all the avenues of their pasturage;—and when he perceives an object of alarm, he makes a sharp hissing noise, at the sound of which all the rest run towards him, to judge for themselves of the nature of the danger. If they discover a beast of prey or a hunter, the most experienced puts himself at their head—and they bound along, one after the other, into the most inaccessible places.

It is then that the labours of the hunter commence; for then carried away by the excitement, he knows no danger. He crosses the snows, without thinking of the abysses which they may cover; he plunges into the most dangerous passes of the mountains—he climbs up, he leaps from rock to rock, without considering how he can return. The night often finds him in the heat of the pursuit; but he does not give it up for this obstacle. He considers that the chamois will stop during the darkness, as well as himself, and that on the morrow he may again reach them. He passes then the night, not at the foot of a tree, nor in a cave covered with verdure, as does the hunter of the plain—but upon a naked rock, or upon a heap of rough stones, without any sort of shelter. He is alone, without fire, without light; but he takes from his bag a bit of cheese and some of the barley-bread, which is his ordinary food—bread so hard that he is obliged to break it between two stones, or to cleave it with the axe which he always carries with him to cut steps which shall serve for his ladder up the rocks of ice. His frugal meal being soon ended, he puts a stone under his head, and is presently asleep, dreaming of the way the chamois has taken. He is awakened by the freshness of the morning air; he rises, pierced through with cold; he measures with his eyes the precipices which he must yet climb, to reach the chamois; he drinks a little brandy, (of which he always carries a small provision,) throws his bag across his shoulder, and again rushes forward to encounter new dangers. These daring and persevering hunters often remain whole days in the dreariest solitudes of the glaciers of Chamouni; and during this time, their families, and, above all, their unhappy wives, feel the keenest alarm for their safety.

And yet with the full knowledge of the dangers to be encountered, the chase of the chamois is the object of an insurmountable passion. Saussure knew a handsome young man, of the district of Chamouni, who was about to be married; and the adventurous hunter thus addressed the naturalist:—"My grandfather was killed in the chase of the chamois; my father was killed also; and I am so certain that I shall be killed myself, that I call this bag, which I always carry in hunting, my winding sheet: I am sure that I shall have no other; and yet if you were to offer to make my fortune, upon the condition that I should renounce the chase of the chamois, I should refuse your kindness." Saussure adds, that he went several journeys in the Alps with this young man, that he possessed astonishing skill and strength; but that his temerity was greater than either; and that two years afterwards he met the fate which he anticipated, by his foot failing on the brink of a precipice to which he had leaped. It is the chase itself which attracts these people, more than the value of the prey; it is the alternation of hope and fear—the continual excitement—the very dangers themselves—which render the chamois-hunter indifferent to all other pleasures. The same passion for hardy adventure constituted the chief charm of the soldier's and the sailor's life; and, like all other passions, to be safe and innocent, it must be indulged in great moderation—near akin as it is to one of our most senseless and mischievous propensities, gambling.

The very few individuals of those who grow old in this trade bear on their countenances the traces of the life which they have led. They have a wild and somewhat haggard and desperate air, by which they may be recognized in the midst of a crowd. Many of the superstitious peasants believe that they are sorcerers—that they have commerce with the evil spirit, and that it is he that throws them over the precipices. When the enormous glaciers and summits of Mont Blanc are beheld from the valleys, it is indeed almost miraculous that any mortal should be found hardy enough to climb them; and it is not unnatural that a simple peasant should believe that somewhat above human excitement had inspired these perilous undertakings. To the traveller, or to the native of the vale of Chamouni, Mont Blanc is an object of awe and astonishment; and the devotion of the instructed, and the superstition of the unenlightened, are perhaps equally tributes to the God of nature, when they thus look upon one of the grandest of natural objects—

"The dread ambassador from earth to heaven."

The chamois is now getting rare in Switzerland, in consequence of the inhabitants being allowed to hunt him at all seasons; but the race may be expected again to multiply, as the old regulations for determining the periods of hunting are again introduced.—*From "The Menageries," vol. I.*

The skin of the chamois was once famous, when tanned, for its softness and warmth; at present, however, since the art of tanning has been brought to greater perfection, the leather called *shammoy* is made also from those of the tame goat, the sheep, and the deer. Many medicinal virtues also were said to reside in the blood, fat, gall, and the concretion sometimes found in the stomach of this animal, called the *German bezoar*. The fat, mixed with milk, was said to be good in ulcers of the lungs. The gall was said to be useful in strengthening the sight; the stone, which is about the size of a walnut, and blackish, was formerly in great request for having the same virtues with oriental bezoar. However, in the present enlightened state of physic, all these medicines are quite out of repute; and although we have the names of several medicines procurable from quadrupeds, yet, except the musk or hartshorn alone, I know of none in any degree of reputation. It is true, the fat, the urine, the beak, and even the dung of various animals, may be found efficacious, where better remedies are not to be had; but they are far surpassed by many at present in use, whose operations we know, and whose virtues are confirmed by repeated experience.

Such are the quadrupeds that more peculiarly belong to the goat kind. Each of these, in all probability, can engender and breed with the other; and were the whole race extinguished, except any two, these would be sufficient to replenish the world, and continue the kind. Nature, however, proceeds in her variations by slow and insensible degrees, and scarcely draws a firm distinguished line between any two neighbouring races of animals whatsoever. Thus, it is hard to discover where the sheep ends, and the goat begins; and we shall find it still harder to fix precisely the boundaries between the goat kind and the deer. In all transitions from one kind to the other, there are to be found a middle race of animals that seem to partake of the nature of both, and that can precisely be referred to neither. That race of quadrupeds, called the *gazelles*, are of this kind; they are properly neither goat nor deer, and yet they have many of the marks of both; they make the shade between these two kinds, and fill up the chasm in nature.

THE GAZELLE.[1]

The Gazelles, of which there are several kinds, can, with propriety, be referred neither to the goat nor the deer, and yet they partake of both natures. Like the goat they have hollow horns that never fall, which is otherwise in the deer. They have a gall-bladder which is found in the goat, and not in the deer; and, like that animal, they feed rather upon shrubs than grassy pastures. On the other hand, they resemble the roebuck in size and delicacy of form; they have deep pits under the eyes like that animal; they resemble the roebuck in the colour and nature of their hair: they resemble him in the bunches upon their legs, which only differ in being upon the fore-legs in these, and on the hind-legs in the other. They seem, therefore, to be of a middle nature between these two kinds; or, to speak with greater truth and precision, they form a distinct kind by themselves.

The distinguishing marks of this tribe of animals, by which they differ both from the goat and the deer, are these; their horns are made differently, being annulated or ringed round, at the same time that there are longitudinal depressions running from the bottom to the point. They have bunches of hair upon their fore-legs; they have a streak of black, red, or brown, running along the lower part of their sides, and three streaks of whitish hair in the internal side of the ear. These are characters that none of them are without; besides these, there are others which, in general, they are found to have, and which are more obvious to the beholder. Of all animals in the world, the gazelle has the most beautiful eye, extremely brilliant, and yet so meek, that all the eastern poets compare the eyes of their mistresses to those of this animal.[1] A gazelle-eyed beauty is considered as the highest compliment that a lover can pay; and, indeed the Greeks themselves thought it no inelegant piece of flattery to resemble the eyes of a beautiful woman to those of a cow. The gazelle, for the most part, is more delicately and finely limbed than even the roebuck; its hair is as short, but finer and more glossy. Its hinder legs are longer than those before, as in the hare, which gives it greater security in ascending or descending steep places. Their swiftness is equal, if not superior, to that of the roe; but as the latter bounds forward, so these run along in an even uninterrupted course. Most of them are brown upon the back, white under the belly, with a black stripe separating those colours between. Their tail is of various lengths, but in all covered with pretty long hair; and their ears are beautiful, well placed, and terminating in a point. They all have a cloven hoof, like the sheep; they all have permanent horns; and the female has them smaller than the male.

---

[1] *The gazelline group.*—Of the great genus antelope, there appear to be two parallel lines of affinities, descending with trifling interchanges of subordinate characters, down to the lower groups included in it. The first with horns in both sexes, through various classes till we arrive at those which depart from the slender structure of the former, and gradually assume more the characters of Capra and Ovis. The larger species live in families or herds, but the smaller are gregarious, keeping at a distance from wooded scenes, and residing principally on the barren deserts; these, however, they will quit in the night, to approach cultivation, and it is said in the desolated provinces of Abyssinia, they are fond of resorting to the fields, where the result of former agriculture has left abundance of grain growing wild, to seek cover and food, and thus concealed, they are hunted with difficulty. The Arabs and Bedouins of Africa and Western Asia, sometimes shoot them by watching their approach to the springs, or hunt them by contriving to get suddenly among the herd, and throwing a heavy stick horizontally at the nearest, and generally breaking the legs of one or more. The nobles in Persia, and the wealthy Turks, and Moors pursue them with the hawk, or slip the Persian lynx to surprise them; but in all these cases, even when the hawk is flown, it is necessary to circumvent the quarry, unless the herd be so large as to exceed the bounds of alarm, or it would be labour in vain to reach them. Although they feed most about dawn and twilight, wandering travellers sometimes come suddenly at night upon a herd, and it is observed, that if no dogs be present, they will scarcely rise and go further than a short distance to lie down again; but if unusual noise disturb them, the whole trot off and evince symptoms of anxiety till the return of day-light.—*Cuvier.*

Of these animals Mr Buffon makes twelve varieties; which, however, is much fewer than what other naturalists have made them. The first is the *gazella*, properly so called, which is of the size of the roebuck, and very much resembling it in all the proportions of its body, but entirely differing, as was said, in the nature and fashion of the horns, which are black and hollow, like those of the ram or the goat, and never fall. The second he calls the *kevel*, which is rather less than the former; its eyes also seem larger; and its horns, instead of being round, are flatted on the sides, as well in the male as the female. The third he calls the *corin*, which very much resembles the two former, but that it is still less than either. Its horns also are smaller in proportion, smoother than those of the other two, and the annular prominences belonging to the kind are scarcely discernible, and may rather be called wrinkles than prominences. Some of these animals are often seen streaked like the tiger. These three are supposed to be of the same species. The fourth he calls the *zeiran*, the horns only of which he has seen; which, from their size, and the description of travellers, he supposes to belong to a larger kind of the gazelle, found in India and Persia, under that denomination.

The fifth he calls the *koba*, and the sixth the *kob;* these two differ from each other only in size, the former being much larger than the latter. The muzzle of these animals is much longer than those of the ordinary gazelle; the head is differently shaped, and they have no depressions under the eyes. The seventh he calls after its Egyptian name, the *algazel;* which is shaped pretty much like the ordinary gazelle, except that the horns are much longer, being generally three feet from the point to the insertion; whereas, in the common gazelle, they are not above a foot; they are smaller also, and straighter, till near the extremities, when they turn short, with a very sharp flexure; they are black and smooth, and the annular prominences are scarcely observable. The eighth is called the *pasan;* or, by some, the *bezoar goat*, which greatly resembles the former, except a small variety in their horns; and also with this difference, that as the algazel feeds upon the plains, this is only found in the mountains. They are both inhabitants of the same countries and climate, being found in Egypt, Arabia, and Persia. This last is the animal famous for that concretion in the intestines or stomach, called the *oriental bezoar*, which was once in such repute all over the world for its medicinal virtues. The word *bezoar* is supposed to take its name either from the pazan or pazar, which is the animal that produces it; or from a word in the Arabic language, which signifies *antidote* or *counter-poison*. It is a stone of a glazed blackish colour, found in the stomach or the intestines of some animal, and brought over to us from the East Indies. Like all other animal concretions, it is found to have a kind of nucleus, or hard substance within, upon which the external coatings were formed; for, upon being sawed through, it is seen to have layer over layer, as in an onion. This nucleus is of various kinds; sometimes the buds of a shrub, sometimes a piece of a stone, and sometimes a marcasite. This stone is from the size of an acorn to that of a pigeon's egg; the larger the stone, the more valuable it is held; its price increasing, like that of a diamond. There was a time when a stone of four ounces sold in Euope for above two hundred pounds; but at present the price is greatly fallen, and they are in very little esteem. The bezoar is of various colours; sometimes of a blood colour, sometimes of a pale yellow, and of all the shades between these two. It is generally glossy, smooth, and has a fragrant smell, like that of ambergris, probably arising from the aromatic vegetables upon which the animal that produces it feeds. It has been given in vertigoes, epilepsies, palpitations of the heart, colic, and jaundice; and in those places where the dearness, and not the value of medicines is consulted, in almost every disorder incident to man. In all, perhaps, it is equally efficacious, acting only as an absorbent powder, and possessing virtues equal to common chalk, or crabs-claws. Judicious physicians have therefore discarded it; and this celebrated medicine is now chiefly consumed in countries where the knowledge of nature has been but little advanced. When this medicine was in its highest reputation, many arts were used to adulterate it; and many countries endeavoured to find out a bezoar of their own. Thus we had occidental bezoar, brought from America; German bezoar, which has been mentioned before; cow bezoar; and monkey bezoar. In fact, there is scarcely an animal, except of the carnivorous kinds, that does not produce some of these concretions in the stomach, intestines, kidneys, bladder, and even in the heart. To these, ignorance may impute virtues that they do not possess; experience has found but few cures performed by their efficacy: but it is well known, that they often prove fatal to the animal that bears them. These concretions are generally found in cows, by their practice of licking off their hair, which gathers in the stomach into the shape of a ball, acquires a surprising degree of hardness, and sometimes a polish like leather. They are often as large as a goose-egg; and when become too large to pass, block up the passage of the food, and the animal dies. The substance of these balls, however, is different from the bezoar mentioned above; being rather a concretion of hair than of stone. There is a bezoar found in the gall-bladder of a boar, and thence called *hog bezoar*, in very great esteem; but perhaps with as little justice as any of the former. In short, as we have already observed, there is scarcely an animal, or scarcely a part of their bodies, in which concretions are not formed; and it is more than probable, as Mr Buffon justly remarks, that the bezoar so much in use formerly, was not the production of the pazar, or any one animal only, but that of the whole gazelle kind; who, feeding upon odoriferous herbs and plants, gave this admirable fragrance to the accidental concretions which they were found to produce. As this medicine, however, is but little used at present, our curiosity is much abated as to the cause of its formation. To return, therefore, to the varieties in the gazelle tribe, the ninth is called the *ranguer*, and is a native of Senegal. This differs somewhat in shape and colour from the rest; but particularly in the shape of its horns, which are straight to near the points, where they crook forward, pretty much in the same manner as in the chamois they crook backward. The tenth variety of the gazelle is the *antelope*, so well known to the English, who have given it the name. This animal is of the size of a roebuck, and resembles the gazelle in many particulars, but differs in others: it has deeper eye-pits than the former; the horns are formed differently also, being about sixteen inches long, almost touching each other at the bottom, and spreading as they rise, so as at their tips to be sixteen inches asunder. They have the annular prominences of their kind, but not so distinguishable as in the gazelle: however, they have a double flexure, which is very remarkable, and serves to distinguish them from all others of their kind. At the root they have a tuft of hair, which is longer than that of any part of the body. Like others of the same kind, the antelope is brown on the back, and white under the belly; but these colours are not separated by the black streak which is to be found in all the rest of the gazelle kinds. There are different sorts of this animal, some with larger horns than others and others with less. The one which makes the eleventh variety in the gazelle kind, Mr Buffon calls the *lidme*, which has very long horns; and the other, which is the twelfth and last, he calls the *Indian antelope*, the horns of which are very small.[1]

---

[1] Moore, in his Lalla Rookh, takes advantage of the fine eye of the gazelle:—

Oh, ever thus, from childhood's hour,
  I've seen my fondest hopes decay:
I never loved a tree or flower,
  But 'twas the first to fade away.
I never nursed a young gazelle,
  To glad me with its soft black eye,
But when it came to know me well,
  And love me—it was sure to die."

---

[1] The Indian antelope is smaller than the fallow-deer, with a lengthened head, ending in a rather full and round mouth, surmounted by a small moist muzzle: the eyes are full, soft, and dark-hazel, with a well-defined suborbital opening beneath; the ears middle-sized and pointed; and the horns, placed a little above the orbits, are from fifteen to twenty inches long, which, as the animal advances in age, become more and more spiral, though when younger they have little more than three flexures. The females are without horns. They are gravid nine months, from which considerable longevity is to be presumed. One kid is produced at a birth, too weak to rise from the ground for some days; at length it is led out from the cover by the dam, and follows the herd to the third year, when it is expelled by the jealousy of the leading buck, to wander at some distance, exposed to the grasp of the tiger, or the weapons of sportsmen. Thus left to their own resources, many perish: the others become vigilant, and even bold. Most of the specimens procured are males of this class, but many precautions are necessary to capture them, so great is their vigilance and distrust. This species resides in India in herds of fifty or sixty does or females, led by a dark-coloured buck. They remain invariably on the open plains, so as to see danger from a distance. Captain Williamson and other sportsmen state, that when a herd is collected to lie down and ruminate on some favourite spot, the young males and some females are detached two or three hundred yards each way to keep

To these may be added three or four varieties more, which it is not easy to tell whether to refer to the goat or the gazelle, as they equally resemble both. The first of these is the *bubalus*, an animal that seems to partake of the mixed natures of the cow, the goat and the deer. It resembles the stag in the size and the figure of its body, and particularly in the shape of its legs. But it has permanent horns, like the goat; and made entirely like those of the gazelle kind. It also resembles that animal in its way of living; however, it differs in the make of its head, being exactly like the cow in the length of its muzzle, and in the disposition of the bones of its skull; from which similitude it has taken its name. This animal has a narrow long head; the eyes are placed very high; the forehead short and narrow; the horns permanent, about a foot long, black, thick, annulated, and the rings of the gazelle kind, remarkably large; its shoulders are very high, and it has a kind of bunch on them, that terminates at the neck; the tail is about a foot long, and tufted with hair at the extremity. The hair of this animal is remarkable in being thicker at the middle than at the root: in all other quadrupeds, except the elk and this, the hair tapers off from the bottom to the point; but in these each hair seems to swell in the middle, like a nine-pin. The bubalus also resembles the elk in size, and the colour of its skin; but these are the only similitudes between them; as the one has a very large branching head of solid horns that are annually deciduous, the other has black, unbranching, hollow horns, that never fall. The bubalus is common enough in Barbary, and has often been called by the name of the *Barbary cow*, from which animal it differs so widely. It partakes pretty much of the nature of the antelope; like that, having the hair short, the hide black, the ears pointed, and the flesh good for food.

The second anomalous animal of the goat kind, Mr Buffon calls the *condoma*.[1] It is supposed to be equal in size to the largest stag, but with hollow horns, like those of the goat kind, and with varied flexures, like those of the antelope. They are above three feet long; and at their extremities about two feet asunder. All along the back there runs a white list, which ends at the insertion of the tail; another of the same colour crosses this, at the bottom of the neck, which it entirely surrounds; there are two more of the same kind running round the body, one behind the fore-legs, and the other running parallel to it before the hinder. The colour of the rest of the body is grayish, except the belly, which is white: it has also a long gray beard; and its legs, though long, are well proportioned.

The third that may be mentioned, he calls the *guiba*. It resembles the gazelles in every particular, except in the colour of the belly, which, as we have seen, is white in them, but in this is of a deep brown. Its horns also are not marked with annular prominences, but are smooth and polished. It is also remarkable for white lists, on a brown ground, that are disposed along the animal's body, as if it were covered with harness. Like the former, it is a native of Africa.

The *African wild goat* of Grimmius is the fourth. It is of a dark ash-colour; and in the middle of the head is a hairy tuft, standing upright; on both sides, between the eyes, and the nose, there are very deep cavities, greater than those of the other kinds, which contain a yellow oily liquor, coagulating into a black substance, that has a smell between musk and civet. This being taken away, the liquor again runs out, and coagulates, as before. These cavities have no communication with the eyes, and, consequently, this oozing sub-

---

watch, especially if there be clumps of grass or bushes, behind which a man might lurk unseen. "Except for such a precaution it is folly," continues this well informed sportsman, "to slip grey-hounds after them, for, excepting by surprise, success is not to be expected, but perhaps at the expense of their lives." The height and distance of their bounds are wonderful, and said to be at least twelve feet from the ground, and over twenty-five or thirty feet of space, and as it were for their own amusement, appearing to deride such dogs as follow them. The chase, therefore, as an amusement (for the venison is dry and lean) is conducted by the Mahomedan and Hindoo princes with hawks who fly at and fix their talons on the head and throat of the quarry, till the dogs can come up; or with the cheetah, by surprise, as is also practised in Persia. They are found over the whole peninsula of India, to the northward and westward as far as the Indus; but as they do not resort to the sandy deserts, it is probable that they extend along the more fertile uplands of the Persian gulf, particularly as we have been assured that our Indian travellers met them near Bassora on their way home overland.

[1] The *condoma*, or striped antelope, is a beautiful, tall animal, inhabiting the Cape of Good Hope; has long, slender shanks; is larger, though not so clumsy, as the elk antelope. Its horns are smooth, twisted spirally, with a prominent edge or rib following the wreaths; they are three feet nine inches long, of a pale brown colour, close at the base, and at the points round and sharp. The colour of this animal is a rusty brown; along the ridge of the back there is a white stripe mixed with brown; from this are eight or nine white stripes, pointing downwards; the forehead and fore part of the nose are brown; a white stripe runs from the corner of each eye, and meets just above the nose; upon each cheek-bone there are two small white spots; the inner edges of the ears are covered with white hair, and the upper part of the neck is adorned with a brown mane, an inch long; beneath the neck, from the throat to the breast, are some long hairs hanging down; the breast and belly are grey; the tail is two feet long, brown above, white beneath, and black at the end. The striped antelope, though a tall and slender animal, is not so swift as many of the gazelle kind, and is easily overtaken by the hounds.

stance can have nothing of the nature of tears.

To this we may add the *chevrotin*, or little Guinea deer, which is the least of all cloven-footed quadrupeds, and perhaps the most beautiful; its legs, at the smallest part, are not much thicker than the shank of a tobacco pipe: it is about seven inches high, and about twelve from the point of the nose to the insertion of the tail. It is the most delicately shaped animal in the world, being completely formed like a stag in miniature; except that its horns, when it has any, are more of the gazelle kind, being hollow and annulated in the same manner. It has two canine teeth in the upper jaw; in which respect it differs from all other animals of the goat or deer kind, and thus makes a species entirely distinct by itself. This wonderful animal's colour is not less pleasing; the hair, which is short and glossy, being in some of a beautiful yellow, except on the neck and belly, which is white. They are natives of India, Guinea, and the warm climates between the tropics, and are found in great plenty. But though they are amazingly swift for their size, yet the negroes often overtake them in the pursuit, and knock them down with their sticks. They may be easily tamed, and then they become familiar and pleasing; but they are of such delicate constitutions, that they can bear no climate but the hottest; and they always perish with the rigours of ours, when they are brought over. The male in Guinea has horns; the female is without any; as are all the kinds of this animal, to be found either in Java or Ceylon, where they chiefly abound.[1]

Such is the list of gazelles; all which pretty nearly resemble the deer in form and delicacy of shape; but have the horns hollow, single, and permanent, like those of the goat. They properly fill up, as has been already observed, the interval between these two kinds of animals; so that it is difficult to tell where the goat ends, and the deer may be said to begin. If we compare the gazelles with each other, we shall find but very slight distinctions between them. The turn or the magnitude of the horns, the different spots on the skin, or a difference of size in each, are chiefly the marks by which their varieties are to be known; but their way of living, their nature, and their peculiar swiftness, all come under one description.[2]

---

[1] The author has here confounded together two animals very distinct in their formation and manners; the pigmy antelope, and the pigmy musk. The former is a native of the hottest parts of Africa, and, like all others of its tribe, is furnished with horns, and wants the canine teeth. It is in height about nine inches, and is said to be so active, as to be able to leap over a wall twelve feet high. Its general colour is a bright bay; the horns are straight, short, strong, pointed, and quite black; the legs are hardly thicker than a quill. The pigmy musk is a native of many parts of the East Indies. It has no horns, and in the upper jaw there are a pair of projecting tusks or canine teeth; and it has no appendicular or false hoofs. See a description of it in the notes to next chapter.

[2] Africa is the great nursery of the antelopes. They there fill up the place which the deer tribe occupy in other countries, a tribe of which the southern and central regions of Africa appear to be destitute. With the idea of an antelope we are apt to associate all that is graceful and elegant in figure, and all that is active and sprightly in movement. To many it is true such a description applies. The gazelle and the spring-bok offer instances of exquisite proportions, and with slender and tapering limbs, they bound along with astonishing ease and celerity. To others, however, such a description will not apply. Their size and proportions ally them to the ox tribe; their gait is slow and heavy, their figure clumsy, and their eyes, instead of beaming with animation, are dull and spiritless. We may here instance the Canna (*Antilope oreas*, Pall.). This animal is a native of South Africa, where it is commonly designated the eland or elk. It is of large size and ponderous form, weighing, when full grown, from seven to nine hundred-weight, and is commonly very fat. Its flesh being in high estimation, it is much hunted, and falls an easy prey to its pursuers, for it can neither run long, nor fast. It lives in large herds, which often permit a man on horseback to ride into their midst without taking to flight. The withers rise, from the length of the spinous process of the vertebræ of that part, into a sort of hump; and the neck, compressed at the sides as in the ox, is furnished with a pendant dewlap. The Caama or Hartebeest (*A. caama*, Cuv.), and the Koba, or grande vache brune, of the French (*A. koba*, Ogilb.), may be also adduced. While on the one hand we see certain groups of antelopes closely allied to the ox tribe, on the other hand there are not wanting those which in form and habits closely approximate to the goat. The chamois of the Alps (*A. rupicapra*), the goral of the elevated plains of the Himalayan range in India (*A. goral*, Hardw.), the Thar of the same range (*A. Thar*, Hodges), the Prong-buck of the rocky mountains of North America (*A. furcifer*, H. Smith), and the Klipspringer of the inaccessible mountains of South Africa (*A. oreotragus*, Forst.), are examples in point. Were we then to compare the eland on the one side, and the chamois on the other, with the gazelle of the desert, we should see at once the division line between the antelopes as a family, and the family of the ox; and that of the goat is purely arbitrary, for it will be evident that many of the larger antelopes are far more nearly allied to the ox, than to the gazelle, while the prong-horned antelope and chamois both in general form and habits represent the goat. The fact is, that the antelopes as they stand arranged in most systematic works consist of a number of distinct *forms*, or *genera*, ill-assorted together under one head;—these forms have their own exclusive characters, and stand in different degrees of relationship to each other; each form too, has its peculiar habits. Some with a muzzle covered with hair browse upon shrubs, the prehensile power of the lips fitting them for this action; others again, with a naked muzzle like that of the ox, graze the herbage of the field. Some choose the arid desert as their abode, and live in the wilds in vast herds, content with the scattered shrubs which they afford; some prefer the luxuriant borders of rivers, and plains rich in vegetation; some make the mountain ridges their home, and fearlessly traverse the edge of the most stupendous precipices, leaping from crag to crag, beyond the reach of the most daring hunter. Others conceal themselves amidst

The gazelles are, in general, inhabitants of the warmer climates; and contribute, among other embellishments, to add beauty to those forests that are for ever green. They are often seen feeding in herds, on the sides of the mountains, or in the shade of the woods; and fly all together, upon the smallest approaches of danger. They bound with such

---

dense thicket and underwood, through which they dive with peculiar address; one species indeed has acquired the name of duikerbok, (diving goat) from this remarkable habit.

The antelopes, then (to retain the word), are, as we have endeavoured to explain, resolvable into many distinct genera. One of the most remarkable, if indeed not the most so of all, is that to which Colonel H. Smith has assigned the title of *Catoblepas*. It includes three allied species: the Gnu (*Catoblepas Gnu*), the Kokoon (*C. taurina*), and the brindled Gnu (*C. gorgon*).

The term Catoblepas (Κατωϐλεψ) was given by Ælian to a savage animal of terrific aspect, inhabiting Africa, the description of which renders it very probable that the gnu was the creature thus designated. Pliny (ch. viii. 32. Valpy Ed. 1826) states it to be a native of Æthiopia, near the rise of the Nile; adding, that it is of moderate bulk, but sluggish in its limbs, and furnished with a ponderous head, which it carries low, and that its glance is deadly,—a description certainly not applicable to the gnu, and indeed too vague and extravagant to require the serious notice of the naturalist. The gnu, however, is so strange an animal, that we cannot be surprised if the ancients invested it with something of the marvellous. It appears as if it were a compound of the horse, ox, and stag, for it partakes of the characters of all three, and not the least of those of the horse; in fact, the neck, body, and tail are those of a well-formed small horse; the former is furnished with a mane, and the tail is long and flowing. The limbs are slender, vigorous, well-knit, and resemble those of a stag,—while the head and horns remind us of the buffalo. The eyes are lowering, and expressive of great ferocity; the horns, which are common to both sexes, closely resemble those of the savage Cape buffalo, except that they are smaller: they arise from a basal mass of horn, expanding like a helmet over the forehead, whence they sweep downwards between the eyes, and then suddenly turn upwards, and somewhat outwards, ending in a sharp point. Their situation is altogether such as to overshadow the eyes, producing an aspect of suspicion and vindictiveness. The chaffron is furnished with a mane-like tuft of bristly hairs; and the chin and throat are covered with hairs of a similar character, also forming a shaggy beard, while a full mane flows down from the under-side of the neck, and from between the fore-limbs; that along the upper ridge of the neck being thick and upright. The head is heavy; and the muzzle is expanded into a thick muscular valve, or flap, which shuts down like a lid, so as to close the aperture of the nostrils, which are thus capable of being opened or closed at will. The lachrymal sinus consists of a small gland below the angle of each eye, and concealed in a tuft of long hair, by which it is entirely surrounded.

The gnu is a native of the wild karroos of South Africa, and the hilly districts, where it roams sometimes singly, but mostly in large herds, which migrate according to the season. The extent of its range in the interior regions is not known. As far, however, as travellers have penetrated, herds have been met and chased: for its flesh is prized as food both by the natives and the colonists. They are, however, extremely wild, and not to be approached without difficulty. On the first alarm, away scours the troop, not in a tumultuous mass, but in single file, following a leader; and as they are seen galloping in the distance over the plain, they so much resemble zebras, or quaggas,—tenants of the same wilds—that were it not for the difference of colour, they might easily be mistaken for those animals. The general colour of the gnu is deep umber-brown, ranging upon black; the tail and mane are grey,—the latter, indeed, nearly white. Their speed, as might be expected from the vigour and compactness of their body and limbs, is very great. When first alarmed, however, they do not exert it, but plunge about, flinging out their heels, butting at various objects, and exhibiting emotions of violent fury. It is seldom that they venture upon an attack unless hard pressed, or wounded, when they defend themselves with desperation: dropping on their knees, they dart forward upon their rash enemy with extraordinary force and impetuosity,—and unless he be cool and prepared, he cannot escape his fate.

That the gnu is sometimes seen single appears from the account of Sparrman, who observes (vol. ii. p. 131), "On the 24th I was induced to stay a little longer on this spot, by the hopes of shooting a gnu which had been seen ranging by *itself* about this part of the country. *T'Gnu* is the Hottentot name for a singular animal which, with respect to its form, is between the horse and the ox. The size of it is about that of a common galloway, the length of it being somewhat about five feet, and the height of it rather more than four. * * * The gnu then wandering in these parts was probably an old buck, which did not care to keep company any longer with the herd to which it belonged, or had been accidentally separated from it. As this that was seen here kept upon the open plains, and we could not steal upon it by creeping towards it from among the bushes, I endeavoured to overtake it on horseback: and, indeed, at first I got almost within gunshot of the animal, when it showed its vicious disposition in making various curvets and plunges, flinging out behind with one or both legs, and butting against the mole-hills with its horns; but immediately upon this, it fled with considerable velocity in a direct line over the plain as far as the eye could discern it, and I cannot help thinking that this was one that was become furious, as the other *gnus* I have chased since would frequently stop to look back at their pursuers, as soon as they had gained ground of them in any considerable degree. What contributed not a little to this gnu's having escaped me was, that the ground was rocky; and that an ardent desire for dissecting this animal induced me to push my horse on too fast at first, so that in a very little time it was quite out of breath, and all over in a tremor." Indeed, so excessively was the horse fatigued, that Sparrman could not even chase a jackal that was feasting on an elk-antelope shot the day before. At a subsequent period he met with large herds of gnus, and was more successful. Mr Pringle observed the gnu among the hills at Bavian's river: he informs us that its flesh in all its qualities has much resemblance to beef. He also asserts, that like the buffalo and ox, this animal is enraged by the sight of scarlet. "It was one of our amusements to hoist a red handkerchief on a pole, and observe them caper about, lashing their flanks with their long tails and tearing up the ground with their hoofs, as if they were violently excited and ready to run down swiftness, and are so very shy, that dogs or men vainly attempt to pursue them. They traverse those precipices with ease and safety, which to every quadruped else are quite impracticable; nor can any animals but of the winged kind overtake them. Accordingly, in all those countries where they are chiefly found, they are pursued by falcons; and this

---

upon us; and then all at once, as we were ready to fire upon them, to see them bound away, and again go prancing round us at a safer distance." This aversion to scarlet we have ourselves noticed in individuals in captivity, and on one occasion much enraged a gnu by suddenly displaying the scarlet lining of a cloak.

The gnu when taken young may be tamed without much difficulty. Sparrman caught a calf, and as he says "had likewise previously seen and examined another tame one of the same size which was intended as a present for the governor: it was feared, however, that this as well as the young *hartebeests* which they were endeavouring to bring up tame, would be subject to a kind of furor or madness." Why so we are not informed. Mr Pringle assures us that the gnu taken young will become as domesticated as the cattle of the farm, with which it associates, harmlessly going and returning to pasture: it appears however that few farmers like to domesticate it, as it is liable to a cutaneous eruption which it communicates to the cattle, and which is invariably fatal. In confinement the gnu often becomes ferocious, and is not to be approached without caution; the females are less dangerous than the males, and more easily manageable.

With regard to the second species of gnu—viz., the Kokoon (*Catoblepas* or *Antelope taurina*,) it is larger than the preceding species, which it closely resembles, but with which it never associates though it inhabits the same countries. It is far less daring than the gnu, and is sometimes found solitary, but most frequently in herds, which wander over the karroos, or vast plains in the interior. A fine specimen is in the Museum of the "Cape of Good Hope Association for exploring central Africa," and was exhibited at the Egyptian Hall. In the catalogue, it is termed the Brindled or Black-tailed Gnu; but the former title has already been appropriated to the third species (*C. gorgon*.) The second may be used instead of the Booshwanna name, *Kokoon*. We are informed that "the Nu Gariep, or Black River, appears to form the limit of its southern range; and though herds often feed almost upon the very banks of that stream, yet not an individual has been known to cross, —a circumstance the more remarkable, as the common species (*C. gnu*) regularly passes it for the northern districts of the colony. In manner, it appears more ferocious than it really is. It will approach the hunter, as if to do battle with him, and then scamper from him with as much alacrity as the most timid animal that flies at his first glance. It is met with in considerable herds in the more extensive plains north of the Orange river; and when alarmed, each herd decamps in long regular files. The flesh of this species, in common with the other, is much sought after as food, both by the natives and by such colonists as obtain permission to cross the boundaries of the colony for the purpose of hunting, and is considered both wholesome and palatable. The Bechuanas use the skin for their cloaks or mantles." Of the third species, the *C. gorgon* of Colonel Hamilton Smith, little is known. A specimen exists in the Museum of the London Missionary Society, which was brought from South Africa. It is certainly very distinct from either of the preceding animals. Le Vaillant, in his second voyage, notices a variety of the gnu, which is not unlikely to be identical with this. Colonel H. Smith supposes it to be the *Baas* of the Dutch boors of South Africa, the name (which signifies *master*) probably referring to its bold and fierce disposition.

The springer antelope, or springbok (buck) of the Cape of Good Hope is a beautiful species of the genus or family of the antelope. It has received from the Dutch colonists the name of springbok, from the bounding leaps which it takes, and also pronkbok, showy or beautiful buck, from the colours which it discloses in leaping. This latter effect is caused by two folds of the skin, which, ascending from the root of the tail, and terminating upon the croup, dilate when the animal is bounding, and expose a large triangular space, otherwise concealed, of pure white-coloured hair, edged by two dark streaks. The head of the animal is rather short, with somewhat of the expression of a lamb; the neck is slender, the body comparatively bulky, and the legs slender and elegantly turned. It is larger than the gazelle, but of the same make and colour.

Colonel Hamilton Smith's description of the springbok, is vivid and interesting. "It resides," he tells us, "on the plains of South Africa, to an unknown distance in the interior, in flocks, assembling in vast herds, and migrating from north to south, and back with the monsoons. These migrations, which are said to take place in their most numerous form only at the intervals of several years, appear to come from the north-east, and in masses of many thousands, devouring, like locusts, every green herb. The lion has been seen to migrate, and walk in the midst of the compressed phalanx, with only as much room between him and his victims as the fears of those immediately around could procure space by pressing outwards. The foremost of these vast columns are fat, and the rear exceedingly lean, while the direction continues one way; but, with the change of the monsoons, when they return towards the north, the rear become the leaders, fattening in their turn, and leaving the others to starve, and to be devoured by the numerous enemies who follow their march. At all times, when impelled by fear, either of the hunter, or the beast of prey darting among the flock, but principally when the herds are assembled in countless multitudes, so that an alarm cannot spread rapidly, and open the means of flight, they are pressed against each other, and their anxiety to escape impels them to bound up in the air, showing at the same time the white spot on the croup dilated by the effort, and closing again in their descent, and producing that beautiful effect from which they have obtained the name of springer and showy bok."

In the first volume of the 'Menageries,' in the 'Library of Entertaining Knowledge,' there are a number of interesting particulars, some of which were communicated by the late Mr Pringle, respecting the migrations of the springbok. The author of that volume remarks, "The migrations of innumerable companies of springboks from unknown regions in the interior of Africa to the abodes of civilization, are amongst the most extraordinary examples of the fecundity of animal life. The vast quantity of a species of birds of South America, which produce the *guanno* (a manure) in sufficient abundance to be a great article of commerce—the flocks of pigeons of North America—the locusts of Africa—are not more striking than the herds of springboks."

Captain Stockenstrom, a native of the Cape, in a letter addressed to Mr Pringle, which was afterwards appended as a note to Mr Thompson's 'Travels,' and is also given in the volume of the 'Menageries' alluded to, says, "It is scarcely possible for a person passing over some of the extensive tracts of the interior and admiring that elegant antelope, the springbok, thinly scattered over the plains, and bounding in playful innocence, to figure to himself that these ornaments of the desert can often become as destructive as the locusts admirable manner of hunting makes one of the principal amusements of the upper ranks of people all over the East. The Arabians, Persians, and Turks, breed up for this purpose that kind of hawk called the *falcon gentle*, with which, when properly trained, they go forth on horseback among the forests and the mountains, the falcon perching upon the hand

---

themselves. The incredible numbers which sometimes pour in from the north, during protracted droughts, distress the farmer inconceivably. Any attempt at numerical computation would be vain; and by trying to come near the truth, the writer would subject himself, in the eyes of those who have no knowledge of the country, to a suspicion that he was availing himself of a traveller's assumed privilege. Yet it is well known in the interior that, on the approach of the *Trek-bokken*, as these migratory swarms are called, the grazier makes up his mind to look for pasture for his flocks elsewhere, and considers himself entirely dispossessed of his lands until heavy rains fall." Captain Stockenstrom accounts, in the following apparently satisfactory manner, for the cause of the migrations of the springbok. The immense desert tracts between Orange river and the colony of the Cape, westward of the Zeekoe river, though destitute of permanent springs, and therefore uninhabitable by human beings for any length of time, are, notwithstanding, interspersed with stagnant pools, and *vleys*, or natural reservoirs of brackish water, which, however bad, satisfies the game. In these endless plains the springboks multiply, undisturbed by the hunter (except when, occasionally, the Bosjesman destroys a few with his poisoned arrows), until the country literally swarms with them; when, perhaps, one year out of four or five, a lasting drought leaves the pools exhausted, and parches up the soil naturally inclined to sterility. Thus want, principally of water, drives those myriads of animals either to the Orange river or to the Colony, when they intrude in the manner described. But when the thunder-clouds burst on the parched-up country, the swarms again retreat to their more sterile but peaceful and secluded plains.

Mr Pringle once passed through a migratory swarm scattered over the grassy plains near the Little Fish river. He could not profess to estimate their numbers;—he says they *whitened*, or rather *speckled* the country as far as the eye could reach. A gentleman riding with him, better acquainted than Mr Pringle with such scenes, affirmed that, within view, there could not be less than 25,000 or 30,000.

Mr Pringle describes the springbok as easily tamed when caught young. It is occasionally reared as a plaything for the children at the farms of the colonists.

The following extract from the work of the Rev. C. J. Latrobe, who paid a missionary visit to South Africa in 1816, is introduced for the sake of the right-hearted feeling which marks it:—

"Here we were amused by the sight of some hundreds of springboks, one of the most elegant antelopes of this country. They stood in parties of twenty or thirty together, and our sportsmen were all alive endeavouring to approach near enough to make sure of their aim. But all attempts were vain: the bucks suffered them to approach to within gun-shot, when they set off full speed, leaping sometimes over each other. They bounded along, in a species of dance, springing with all four feet at once from the ground, then, swiftly facing about, surveyed their pursuers. Sixteen shot were fired at them, but not in a single instance did it appear that one had been wounded. This afforded me great pleasure; for as we had no dogs to run down and secure any one that might have had a leg broken, or been otherwise hurt, it must have given pain to any feeling mind to know that the poor animal was lamed, and grievously suffering, without benefit to us, and would most likely be made the prey of some cruel ravenous beast. Could we have obtained one of them for our subsistence, the killing of it would have been excusable. The shot fired contributed, though not to our gain, yet to our pleasure, for it set them in motion, and the swiftness and elegance of their movements were well worth observing."

The springbok, like the hare, conceals itself in cover during the day, and resorts to the open plain in the evening and at night, for the purpose of feeding only. The Cape antelope, in fact, perfectly resembles the hare in all its characteristics. It lies continually in its form,—leaving it only to procure food, or to escape from its enemies. The bok is shot in great numbers by the Dutch boors. This sport is usually pursued on horseback, and in the heat of the day. The animal is then lying in its habitual lair, and, on being disturbed by the sportsman, springs from it with a succession of bounds, than which nothing can be more beautiful or graceful. The Dutch boor is generally an unerring shot; but in case the antelope should be only wounded, the buckdog (a species of large mongrel) is always at the heels of his master's horse, and, at the report of his gun, darts forward and secures the animal. It is then placed behind the saddle. The horse used in buck-shooting is the hardy and serviceable animal common to the country. Many of them are so well trained, that they stop the instant the bok gets up, but in most cases a slight check is necessary; the rein is then dropped on the neck, and the horse is motionless.

The Nyl-ghau was quite unknown to the older naturalists. A notice of a nameless "Quadruped brought from Bengal," inserted by Dr Parsons in the forty-third volume of the Philosophical Transactions, and accompanied by an imperfect figure, appears to contain the earliest description of this fine species of antelope. But neither the description nor the figure were recognised as belonging to the Nyl-ghau, when the latter again made its appearance in England in 1767. A pair, male and female, were in that year sent from Bombay as a present to Lord Clive, to whom we are indebted for the first introduction of many rare and interesting animals. Shortly afterwards a second pair, which had been presented to the Queen, were placed by her Majesty, at the disposal of Dr William Hunter, who published also, in the Philosophical Transactions, a full and detailed description of them, together with an excellent figure from the pencil of Stubbs, the most distinguished animal painter of his day. They were immediately adopted by Pennant in his Synopsis, where they were again figured, as a species of antelope; and his classification has been followed by Pallas, and all subsequent systematists.

The male Nyl-ghau is superior in stature to the stag, as well as more robust in his proportions. His head is rather large; his muzzle long and narrow; his ears middle-sized, open, and terminating abruptly in an obtuse point; his neck long and thick; his shoulders surmounted by a slight hump; his hinder quarters much less elevated than his fore parts; his legs thicker than those of most other antelopes; and his tail of considerable length, reaching below the joint of the leg, and end-

of the hunter. Their expedition is conducted with profound silence; their dogs are taught to hang behind; while the men, on the fleetest coursers, look round for the game. Whenever they spy a gazelle at the proper distance, they point the falcon to its object, and encourage it to pursue. The falcon, with the swiftness of an arrow, flies to the animal, that, knowing its danger, endeavours, but too late, to escape. The falcon soon coming up with its prey, fixes its talons, one into the animal's cheek, the other in its throat, and deeply wounds it. On the other hand, the gazelle attempts to escape, but is generally wounded too deeply to run far. The falcon clings with the utmost perseverance, nor ever leaves its prey till it falls; upon which the hunters from behind approaching, take up both, and reward the falcon with the blood of the spoil. They also teach the young ones, by applying them to the dead animal's throat and accustoming them betimes to fix upon that particular part; for if it should happen that the falcon fixed upon any other part of the gazelle, either its back or its haunches, the animal would easily escape among the mountains, and the hunter would also lose his falcon.—They sometimes also hunt these animals with the ounce. This carnivorous and fierce creature being made tame and domestic, generally sits on horseback behind the hunter, and remains there with the utmost composure, until the gazelle is shown; it is then that it exerts all its arts and fierceness; it does not at once fly at its prey, but approaches slily, turning and winding about until it comes within the proper distance, when all at once it bounds upon the heedless animal, and instantly kills it, and sucks its blood. If, on the other hand, it misses its aim, it rests in its place, without attempting to pursue any farther, but seems ashamed of its own inability.

There is still another way of taking the gazelle, which seems not so certain nor so amusing as either of the former. A tame gazelle is bred up for this purpose, who is taught to join those of its kind, wherever it perceives them. When the hunter therefore, perceives a herd of these together, he fixes a noose round the horns of the tame gazelle, in such a manner, that if the rest but touch it they are entangled; and thus prepared, he sends his gazelle among the rest. The tame animal no sooner approaches, but the males of the herd instantly sally forth to oppose him; and, in butting with their horns, are caught in the noose. In this both, struggling for some time, fall together to the ground; and, at last, the hunter coming up, disengages the one, and kills the other. Upon the whole, however, these animals, whatever be the arts used to pursue them, are very difficult to be taken. As they are continually subject to alarms from carnivorous beasts, or from man, they keep chiefly in the most solitary and inaccessible places, and find their only protection from situations of the greatest danger.

CHAP. IV.

OF THE MUSK ANIMAL.

The more we search into nature, the more we shall find how little she is known; and we shall more than once have occasion to find, that protracted inquiry is more apt to teach us modesty, than to produce information. Although the number and nature of quadrupeds

---

ing in a tuft of long hairs. His eyes are full, black, and prominent; and his suborbital sinuses large and obvious. The form of his horns is conical and slightly curved, with the concavity directed inwards and the points turned forwards. They take their origin by a triangular base of considerable thickness, marked with two or three indistinctly elevated rings, but become perfectly round and smooth above, tapering rapidly into a rather obtuse point. Their length is from seven to eight inches; and their colour a uniform dull black, corresponding with that of the hoofs.

The female is much smaller than the male, and at the same time lighter and more slender in her proportions. She is entirely destitute of horns, has less hump on the shoulders, and her hind quarters are more nearly on a level with her fore. Her general colour, as also that of the young male, is a pale reddish brown.

The Nyl-ghaus appear to be by no means generally spread over the peninsula of Hindoostan, but to be confined to its north-western provinces and the countries situated between them and Persia. Bernier, who alone of all the older travellers mentions the animal by name or in such a manner as to admit of its being recognised, introduces it incidentally as one of the beasts which were hunted by the Mogul emperor Aurung-zebe during his progress from Delhi to his summer retreat in Cashmere. It would seem from the numbers of which he speaks as being sometimes taken on those occasions, to be very abundant; but we have not, up to the present time, any particular account of its habits in a state of nature. In captivity it is gentle and familiar, licking the hands of those who offer it bread, and suffering itself to be played with, not only without shyness, but with evident pleasure. There are, however, seasons at which it becomes capricious in its temper. When meditating an attack it falls suddenly upon its fore knees, shuffles onwards in that posture until it has advanced to within a few paces of the object of its irritation, and then darts forward with a powerful spring, and butts with its head in the most determined manner. Its walk is awkward in consequence of the comparative shortness of its hind legs, and the width to which it extends them; but in running this defect is scarcely perceptible. Lord Clive's original specimens several times produced young; but we are not aware that the breed has been continued, or that the same success has attended their introduction in other quarters.

at first glance seems very well known; yet, when we come to examine closer, we find some with which we are very partially acquainted, and others that are utterly unknown. There is scarcely a cabinet of the curious but what has the spoils of animals, or the horns or the hoofs of quadrupeds, which do not come within former descriptions. There is scarcely a person whose trade is to dress or improve furs, but knows several creatures by their skins, which no naturalist has hitherto had notice of. But of all quadrupeds, there is none so justly the reproach of natural historians, as that which bears the musk.[1] This perfume, so well known to the elegant, and so very useful in the hands of the physician, a medicine that has for more than a century been imported from the East in great quantities, and during all that time has been improving in its reputation, is, nevertheless, so very little understood, that it remains a doubt whether the animal that produces it be a hog, an ox, a goat, or a deer. When an animal with which we are so nearly connected, is so utterly unknown, how little must we know of many that are more remote and unserviceable! Yet naturalists proceed in the same train, enlarging their catalogues and

---

[1] The curious animal which yields the strong-scented substance called musk, is a quadruped, or rather belongs to a species of quadrupeds, of the order Pecora, and genus (family) Moschus. It is a native of Thibet, China, Pegu, Siam, Siberia, and other Asiatic countries, from which, accordingly, all the musk used in commerce is derived. Indeed, though various creatures emit from their bodies a scent something similar, the true musk animal has been yet found no where but in Asia. It resembles the roebuck in general appearance, and measures about forty inches in length, twenty-seven in height at the shoulder, and thirty-three at the haunches. The musk animal is devoid of horns; its lower teeth are eight in number, and from the upper jaw, two solitary tusks project downwards and backwards, to the extent of two or three inches. These tusks are composed of a kind of ivory, and resemble a pair of crooked knives. The ears are long and narrow, and the tail very short. Both neck and legs are long in proportion to the body; and the hoofs are divided, like those of the deer and cow. The general colour of the body is a deep iron grey, the hairs being of that hue at their tips, darker in the middle, and pale towards the roots. On each side of the lower jaw is a tuft of hair, about an inch long. The teats, which are two in number, and the absence of the tusks, constitute the only difference between the male and the female. Forests of difficult access are the favourite haunt of the musk animal. Like the deer and goat, it prefers browsing on heights to level pastures, and is most commonly found on the tops of mountains covered with pines. It is exceeding agile, leaping from rock to rock with the ease and fearlessness of the chamois.

This is the general character and appearance of the musk animal. The curious, and in some respects inexplicable, appendage or provision which furnishes the musk, remains now to be described. Near, or rather in, the umbilical region of each animal's body, there is in both sexes a small bag, about the size of a hen's egg, and covered with hairs of considerable length, arising from distinct glandules. Four membranes, or layers of skin, cover this bag, and beneath these is a circular muscle, surrounding the central cavity. In the middle of the bag, externally, is a fleshy protuberance, perforated in the centre by a channel communicating with the hollow within, and termed the excretory duct. A muscle encircles this duct for the purpose of retention or expulsion of the contents of the bag. There is also a channel opening into the bottom of the bag, by which the musk appears to flow into it when secreted by the blood-vessels, which are numerous and large in the parts around. The cavity, at most, cannot hold above half an ounce of musk.

From the appearance of musk, it has been generally conjectured that it is simply extravasated blood. It is a substance of a dark-brown hue, soft when in the bag we have described, but becoming hard and brittle after being exposed to the sun and air. In this latter condition it is when procured; for it is not taken from the body of the animal, either living or dead; that is to say, not in general. The creature, from some cause not well understood, rubs its body against trees and rocks, and by that means expels the contents of the musk-bag. Well acquainted with the tracts and habits of the animal, the natives of the Eastern countries go up and down to gather this precious excretion, which is found sticking to rocks and trees, more or less coagulated with the heat of the sun. In this manner, small as the quantity is which each animal affords, all the musk of commerce is derived. It has been indeed said, that the musk-gatherers often use very different methods to procure this valuable commodity; that they hunt the musk-animals, and kill them with arrows and other weapons for the purpose of cutting away the bag. That this is occasionally done, is undeniable, since the musk is sometimes delivered to the merchants wrapped up in the bag itself. It is improbable, however, that this practice should be general; common sense would dictate the preservation of this valuable creature, rather than its destruction. Some travellers have attributed to the animal an instinct of a curious order, which, were it founded on truth, would explain at once the reason of the musk being exported in the natural state. The animal, according to this account, knowing the purpose for which it is hunted, bites off the bag, and leaves it to the pursuers. But this story is now disbelieved. It has been said, also, that the natives endeavour to take the animal alive sometimes, for a very cruel purpose. Having adopted the idea that musk is nothing else than coagulated blood, they lash the poor musk animal till its skin rises in lumps, around which they tie knots with cord, and afterwards cut off the part. Its contents are then dried by them, and mixed with the musk procured in the natural way. As every portion of the animal partakes more or less of the strange smell peculiar to the secretion of the bag, the deception is not easily discovered. No substance, however, procured in this way from the animal's body, is at all comparable to the natural musk, in fineness and durability of flavour.

Admitting that the musk secreted in the bag approaches very nearly in character to blood, it is difficult to arrive at any rational and just conclusion respecting the purpose of the apparatus altogether. The most probable conjecture is, that it is a secretion for relieving the heat of the creature's blood at certain seasons; though the reason for such a provision being bestowed on this animal in especial, is altogether unknown. Alike mysterious is the reason for the strong smell possessed by musk, supposing it to be a secretion of the character mentioned. The old notion that musk was the consequence of an imposthume or disease, is plainly erroneous. Not only does the musk apparatus occur in the whole race, but each animal also exhibits the rudiments of the provision at birth.

The quantity of musk exported annually from Asia is their names, without endeavouring to find out the nature, and fix the precise history, of those with which we are very partially acquainted. It is the spirit of the scholars of the present age to be fonder of increasing the bulk of our knowledge, than its utility; of extending their conquests, than of improving their empire.

The musk which comes to Europe, is brought over in small bags, about the size of a pigeon's egg, which, when cut open, appear to contain a kind of dusky reddish substance, like coagulated blood, and which, in large quantities, has a very strong smell; but, when mixed and diffused, becomes a very agreeable perfume. Indeed, no substance now known in the world has a stronger or a more permanent smell. A grain of musk perfumes a whole room; and its odour continues for some days without diminution. But in a larger quantity it continues for years together, and seems scarcely wasted in its weight, although it has filled the atmosphere to a great distance with its parts. It is particularly used in medicine, in nervous and hysteric disorders; and is found in such cases to be the most powerful remedy now in use: however, the animal that furnishes this admirable medicine has been very variously described, and is known but very imperfectly.

The description given of this animal by Grew is as follows: "The musk animal is properly neither of the goat nor deer kind, for it has no horns, and it is uncertain whether it ruminates or not; however, it wants the fore-teeth in the upper jaw, in the same manner as in ruminating animals; but at the same time, it has tusks like those of a hog. It is three feet six inches in length, from the head to the tail; and the head is above half a foot long. The fore-part of the head is like that of a greyhound; and the ears are three inches long, and erect, like those of a rabbit; but the tail is not above two inches. It is cloven-footed, like beasts of the goat kind: the hair on the head and legs is half an inch long, on the belly an inch and a half, and on the back and buttocks three inches, and proportionably thicker than in any other animal. It is brown and white alternately from the root to the point; on the head and thighs it is brown, but under the belly and tail white, and a little curled, especially on the back and belly. On each side of the lower jaw, under the corners of the mouth, there is a tuft of thick hair, which is short and hard, and about three quarters of an inch long. The hair in general of this animal, is remarkable for its softness and fine texture; but what distinguishes it particularly are the tusks, which are an inch and a half long, and turn back in the form of a hook; and more particularly the bag which contains the musk, which is three inches long, two broad, and stands out from the belly an inch and a half. It is a very fearful animal, and therefore it has long

---

very great. M. Tavernier, a French traveller, brought to Europe, in one voyage, no less than 7678 bladders, weighing 2557 ounces in whole; and an additional quantity besides, out of bladder, that weighed 452 ounces. The ingenious and crafty Chinese deal largely in musk, and are the most frequent adulterators of it. They mix the true musk with the excrements and blood of animals, and particularly of the musk animal itself, as well as with aromatic gums, seeds, and woods sprinkled with volatile spirits, and stuffed into natural musk bags, or artificial bladders made of the skin of the belly of the creature. The true musk has a natural fold, and is generally clothed in a fine slender skin, which the sophisticators can scarcely imitate; and this is the best way of discovering the deception, for a small quantity of real musk imparts the smell to other substances so perfectly, that the smell is no true criterion. Colour, taste, and weight are equally little to be depended upon. Even when the musk is in the natural bladder (which is too often the case, and indicates to a certainty the death or torture of one of the animals), deceit often exists; for the natives at the very first take away a portion of the substance, and supply its place with earth, &c. The king of Boutan, fearing that the adulterations would soon spoil the musk-trade in his territories, ordered that none of the bladders should be sewed up by his subjects, but that they should be all brought to Boutan, and sealed after due inspection. When carefully preserved in this way from the period of its collection, pure musk is possessed of an odour so powerful, that it will cause the blood to burst from the nostrils, when brought near to them. M. Tavernier brought home one of the musk animals to Paris, and the odour from it was so strong, that it gave headaches to all who approached it.

Musk has been long known and used in the world as a medicinal remedy. We do not allude to the employment of it as a scent, to dissipate headaches, and excite the system through the sense of smell, but to its employment in internal diseases. Its virtues are what are termed in medicine *anti-spasmodic;* that is to say, it obviates spasmodic diseases. Generally, it has been used in all nervous affections. Now-a-days, however, it is ranked among the exploded farragos of the old school of physic. As a scent, it is even considered too strong for modern nerves, at least among the refined classes.

It is not the least remarkable fact concerning musk, that an odour resembling it should be found attached to the bodies of several other animals, none of which have the musk-bag and apparatus. The musk-rat, for example, of Russia and America, emits a smell of this kind, as do also the musk-duck and musk-ox. The excrements, in particular, give out this odour. It is supposed, that it is from the perspiration of the living animal that the musky smell comes. But an affinity of this nature, between the qualities of animal bodies, is less remarkable still than the same affinity when perceived between animals and vegetables. The odour of the musk-rose is indistinguishable from that of the substance found in the bag of the musk animal. Many other plants, such as the musk-orchis, the moschatella, Carduus Benedictus, several species of hyacinths, violets, lilies, marjorams, mosses, &c., evince the same peculiarity. What nice assortment of the principles that constitute odours, is the cause of these similarities, it would be difficult to determine.

ears, and the sense of hearing is so quick that it can discover an enemy at a great distance.[1]

After so long and circumstantial a description of this animal, its nature is but very little known; nor has any anatomist as yet examined its internal structure or been able to inform us whether it be a ruminant animal, or one of the hog kind; how the musk is formed, or whether those bags in which it comes to us be really belonging to the animal, or are only the sophistications of the venders. Indeed when we consider the immense quantities of this substance which are consumed in Europe alone, not to mention the East, where it is in still greater repute than here, we can hardly suppose that any one animal can furnish the supply; and particularly when it must be killed before the bag can be obtained. We are told, it is true, that the musk is often deposited by the animal upon trees and stones, against which it rubs itself when the quantity becomes uneasy; but it is not in that form which we receive it, but always in what seems to be its own natural bladder. Of these Tavernier brought home near two thousand in one year; and as the animal is wild, so many must during that space have been hunted and taken. But as the creature is represented very shy, and as it is found but in some particular provinces of the East, the wonder is, how its bag should be so cheap, and furnished in such great plenty. The bag in common does not cost, if I do not forget, above a crown by retail, and yet this is supposed the only one belonging to the animal; and for the taining of which, it must have been hun and killed. The only way of solving difficulty, is to suppose that these bags are, a great measure, counterfeit, taken from so other animal, or from some part of the sam filled with its blood, and a very little of perfume, but enough to impregnate the r with a strong and permanent odour. It com to us from different parts of the East; fro China, Tonquin, Bengal, and often from Mus covy: that of Thibet is reckoned the best, an sells for fourteen shillings an ounce; that o Muscovy the worst, and sells but for three; the odour of this, though very strong at first, being quickly found to evaporate. Musk was some years ago in the highest request as a perfume, and but little regarded as a medicine; but at present its reputation is totally changed; having been found of great benefit in physic, it is but little regarded for the purposes of elegance. It is thus that things which become necessary, cease to continue pleasing; and the consciousness of their use, destroys their power of administering delight.

CHAP. V.

ANIMALS OF THE DEER KIND.

If we compare the stag and the bull, as to shape and form, no two animals can be more

---

[1] There are now ascertained to be *six* species of musk animals. The species described by our author is the *Thibetian musk*; it lives retired amongst the highest and rudest mountains of Thibet, and some other parts of Asia, Tonquin, and Siberia. In the autumn large flocks of them collect together, in order to change their place, being driven southward by the approaching cold. During this migration the peasants lie in wait for them, and either catch them by means of snares, or kill them with bludgeons. At these times they are often so meagre and languid, from hunger and fatigue, as to be taken without much difficulty. They are gentle and timid, having no weapons of defence but their tusks. Their activity is very great, and they are able to take astonishing leaps over the tremendous chasms of the rocks. They tread so lightly on the snow, as scarcely to leave a mark, while the dogs that are employed in the pursuit of them sink in, and are frequently obliged to desist from the chase. In a state of captivity they live but a very short time. They feed on various vegetables of the mountains. They are usually taken in snares, or shot by cross-bows placed in their tracks, with a string from the trigger for them to tread on, and discharge the bow.

The *Indian musk* is larger than the Thibet musk; it has a head like that of a horse; ears erect, and oblong; its legs are slender, with spurious hoofs; body above of a tawny colour, and beneath whitish. Inhabits several parts of India.

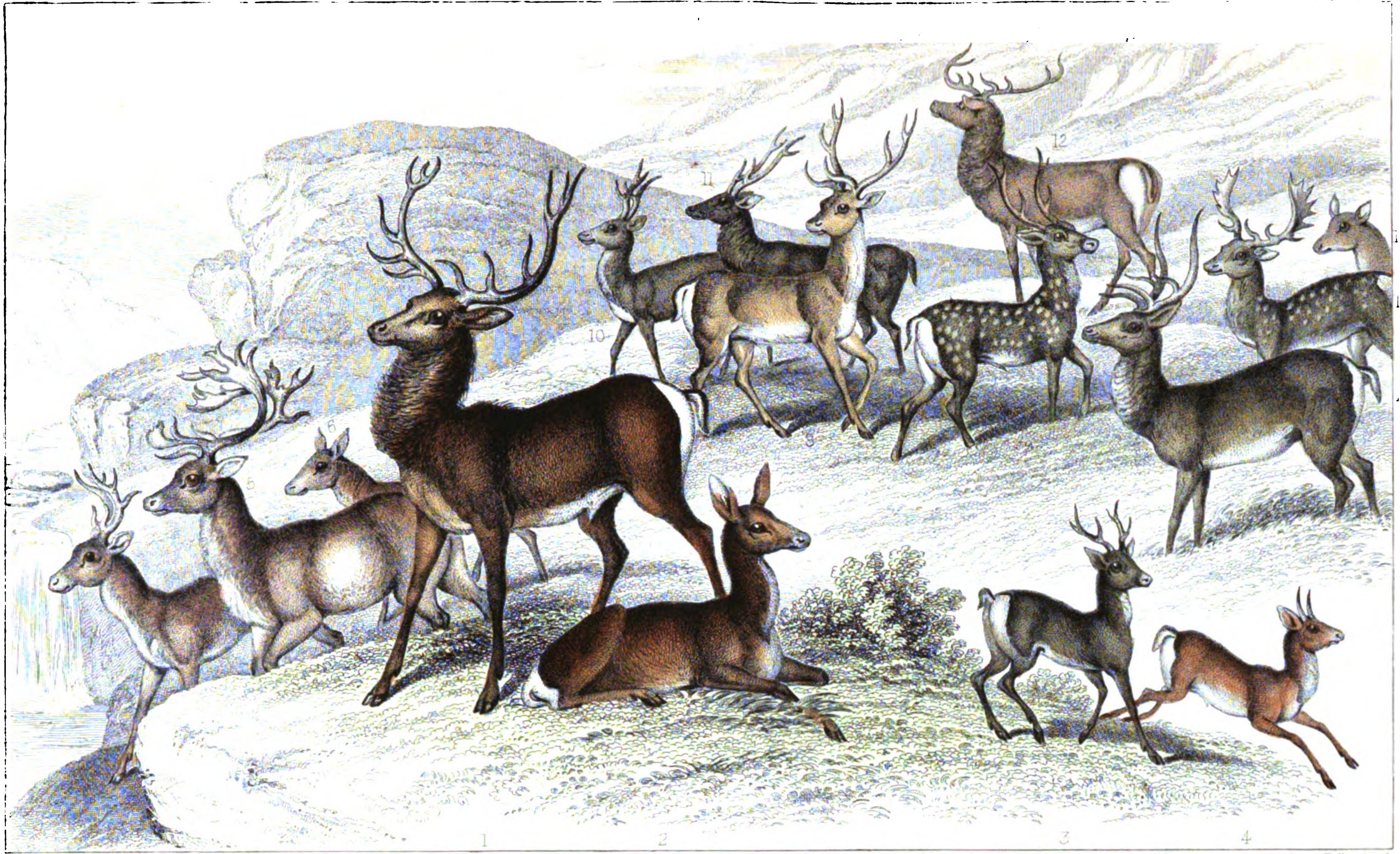
The *Guinea musk* is a native of many parts of India and Java; it is only nine inches and a half in length; its body is of a brown tawny colour, white beneath; its tail is very short, being only one inch long. It has long erect ears; two broad middle foreteeth, the rest are slender; its tusks are very small. This is the animal which our author has confounded with the pigmy antelope, as mentioned in a previous note. There is a variety of the Guinea musk, with its body of a rusty colour, mixed with black, with perpendicular stripes on its neck and throat.

The *Meminna* or *Ceylon musk*, is an inhabitant of the islands of Ceylon and Java; it is seventeen inches long, with long erect ears, and short tail; its body is of a cinereous yellow above, and white beneath; its sides are spotted with white. It very much resembles the *fallow-deer*.

The *Java musk* inhabits the island of Java; is about the size of a rabbit; its body above is a ferruginous colour, beneath longitudinally white; its tail is longish, hairy and white beneath at the tip. Its nose and ears are naked, with pits under the eyebrows; its neck is of a grey colour, mixed with brown hairs, and beneath white, with grey spots almost connected. Under the throat it has two long divergent hairs; crown of the head longitudinally blackish.

The *Brasilian musk* is a native of Guinea and Brazil; it is a hardy animal, as large as a roe, timid, active, and swift; its body is tawny-brown, with a black mouth, and white throat; its hair is soft and short; its head and neck on the upper part brown, under white; its hind legs are longer than the fore; and its ears are four inches long.

[2] The quadrupeds of this tribe have horns which are solid and branched: they are renewed every year, and when young are clothed with a fine velvety vascular skin, which falls off when the horns have attained their



J. Stewart Del. [illegible] Sc.

1. 2. RED DEER HART AND HIND. 3. ROEBUCK. 4. THIBETIAN MUSK-DEER. 5. 6. REINDEER MALE AND FEMALE IN SUMMER DRESS. 7. GUAZUPUCO-DEER. 8. STAG OF PALESTINE. 9. AXIS DEER. 10. GUAZUTI DEER. 11. GREAT RUSA. 12. STAG OF THE NORTH OF EUROPE. 13. WAPITI. 14. 15. FALLOW DEER BUCK & DOE.

Blackie & Son, Glasgow, Edinburgh & London.

unlike; and yet, if we examine their internal structure, we shall find a similitude between them. Indeed, their differences, except to a nice observer, will scarcely be perceivable. All of the deer kind want the gall-bladder: their kidneys are formed differently; their spleen is also proportionably larger; their tail is shorter; and their horns, which are solid, are renewed every year. Such are the slight internal discriminations between two animals, one of which is among the swiftest and the other the heaviest of the brute creation.

The stag is one of those innocent and peaceable animals that seem made to embellish the forest, and animate the solitudes of nature. The easy elegance of his form, the lightness of his motions, those large branches that seem made rather for the ornament of his head than its defence, the size, the strength, and the swiftness, of this beautiful creature, all sufficiently rank him among the first of quadrupeds, among the most noted objects of human curiosity.

The stag or hart, whose female is called a *hind*, and the young a *calf*, differs in size and in horns from a fallow-deer. He is much larger, and his horns are round; whereas in the fallow-kind they are brown and palmated. By these the animal's age is known. The first year the stag has no horns, but a hoary excrescence, which is short, rough, and covered with a thin hairy skin. The next year the horns are single and straight: the third year they have two antlers, three the fourth, four the fifth, and five the sixth; this number is not always certain, for sometimes there are more, and often less. When arrived at the sixth year, the antlers do not always increase; and although the number may amount to six or seven on each side, yet the animal's age is then estimated rather from the size of the antlers, and the thickness of the branch which sustains them, than from their variety. These horns, large as they seem, are, notwithstanding, shed every year, and new ones come in their place. The old horns are of a firm solid texture, and usually employed in making handles for knives and other domestic utensils. But while young, nothing can be more soft or tender; and the animal, as if conscious of his own imbecility at those times, instantly upon shedding his former horns, retires from the rest of his fellows and hides himself in solitudes and thickets, never venturing out to pasture, except by night. During this time, which most usually happens in the spring, the new horns are very painful, and have a quick sensibility of any external impression. The flies also are extremely troublesome to him. When the old horn is fallen off, the new does not begin immediately to appear; but the bones of the skull are seen covered only with a transparent periosteum or skin, which, as anatomists teach us, covers the bones of all animals. After a short time, however, this skin begins to swell, and to form a soft tumour, which contains a great deal of blood, and which begins to be covered with a downy substance that has the feel of velvet, and appears nearly of the same colour with the rest of the animal's hair. This tumour every day buds forward from the point like the graft of a tree, and rising by degrees from the head, shoots out the antlers on either side, so that in a few days, in proportion as the animal is in condition, the whole head is completed. However, as was said above, in the beginning its consistence is very soft, and has a sort of bark, which is no more than a continuation of the integument of the skull. It is velveted and downy, and every where furnished with blood vessels, that supply the growing horns with nourishment. As they creep along the sides of the branches, the print is marked over the whole surface; and the larger the blood vessels, the deeper these marks are found to be: from hence arises the inequality of the surface of the deer's horns; which, as we see, are furrowed all along the sides, the impressions diminishing towards the point, where the substance is as smooth and as solid as ivory. But it ought to be observed, that this substance of which the horns are composed, begins to harden at the bottom, while the upper part remains soft, and still continues growing: from whence it appears that the horns grow differently in deer from those of sheep or cows; in which they are always seen to increase from the bottom. However, when the whole head has received its full growth, the extremities then begin to acquire their solidity; the velvet covering or bark, with its blood-vessels, dry up, and then begin to fall; and this the animal hastens, by rubbing its antlers against every tree it meets. In this manner, the whole external surface being stripped off by degrees, at length the whole head acquires its complete hardness, expansion, and beauty.

It would be a vain task to inquire into the cause of the animal production of these horns; it is sufficient to observe, that if a stag be castrated when its horns are fallen off, they will never grow again; and, on the contrary, if the same operation is performed when they are on, they will never fall off. If only one of his testicles is taken out, he will want the horn on that side; if one of the testicles only

---

full size. In the lower jaw they have eight front teeth: and are generally destitute of canine teeth: but sometimes a single one is found on each side on the upper jaw. There are about fourteen distinct species. They are all extremely active, inhabiting chiefly woods and neglected situations; and in fighting not only make use of their horns, but stamp furiously with their fore feet.

be tied up, he will want the horn of the opposite side. The increase of their provision also tends to facilitate the growth and the expansion of the horns; and Mr Buffon thinks it possible to retard their growth entirely by greatly retrenching their food.[1] As a proof of this, nothing can be more obvious than the difference between a stag bred in fertile pastures, and undisturbed by the hunter, and one often pursued and ill nourished. The former has his head expanded, his antlers numerous, and the branches thick; the latter has but few antlers, the traces of the blood-vessels upon them are but slight, and the expansion but little. The beauty and size of their horns, therefore, mark their strength and their vigour: such of them as are sickly, or have been wounded, never shooting out that magnificent profusion so much admired in this animal. Thus the horns may, in every respect, be resembled to a vegetable substance, grafted upon the head of an animal. Like a vegetable, they grow from the extremities; like a vegetable, they are for a while covered with a bark that nourishes them; like a vegetable, they have their annual production and decay; and a strong imagination might suppose that the leafy productions on which the animal feeds, go once more to vegetate in his horns.[2]

The stag is usually a twelvemonth old before the horns begin to appear, and then a single branch is all that is seen for the year ensuing. About the beginning of spring, all of this kind are seen to shed their horns, which fall off of themselves; though sometimes the animal assists the efforts of nature, by rubbing them against a tree. It seldom happens that the branches on both sides fall off at the same time, there often being two or three days between the dropping of the one and the other. The old stags usually shed their horns first; which generally happens towards the latter end of February, or the beginning of March. Those of the second head, (namely, such as are between five and six years old,) shed their horns about the middle or latter end of March; those still younger, in the month of April; and the youngest of all, not till the middle, or the latter end of May; they generally shed them in pools of water, whither they retire from the heat; and this has given rise to the opinion of their always hiding their horns. These rules, though true in general, are yet subject to many variations; and universally it is known, that a severe winter retards the shedding of the horns. The horns of the stag generally increase in thickness and in height, from the second year of its age to the eighth. In this state of perfection they continue during the vigour of life; but as the animal grows old, the horns feel the impressions of age, and shrink like the rest of the body. No branch bears more than twenty or twenty-two antlers, even in the highest state of vigour; and the number is subject to great variety; for it happens that the stag at one year has either less or more than the year preceding, in proportion to the goodness of his pasture, or the continuance of his security, as these animals seldom thrive when often roused by the hunters. The horns are also found to partake of the nature of the soil: in the more fertile pastures they are large and tender; on the contrary, in the barren soil, they are hard, stunted, and brittle. As soon as the stags have shed their horns, they separate from each other, and seek the plainer parts of the country, remote from every other animal, which they are utterly unable to oppose. They then walk with their heads stooping down, to keep their horns from striking against the branches of the trees above. In this state of imbecility they continue near three months, before their heads have acquired their full growth and solidity; and then, by rubbing them against the branches of every thicket, they at length clear them of the skin which had contributed to their growth and nourishment. It is said by some, that the horn takes the colour of the sap of the tree against which it is rubbed; and that some thus become red, when rubbed against the heath; and others brown, by rubbing against the oak: this, however, is a mistake; since stags kept in parks where there are no trees, have a variety in the colour of their horns, which can be ascribed to nothing but nature. A short time after they have furnished their horns, they begin to feel the impressions of the rut, or the desire of copulation. The old ones are the most forward; and about the end of August, or the beginning of September, they quit their thickets, and return to the mountain in order to seek the hind, to whom they call with a loud tremulous note. At this time their neck is swollen; they appear bold and furious; fly from country to country; strike with their horns against the trees and other obstacles, and continue restless and fierce until they have found the female; who at first flies from them, but is at last compelled and overtaken. When two stags contend for the same female, how timorous soever they may appear at other times, they then seem agitated with an uncommon degree of ardour. They paw up the earth, menace each other with their horns, bellow with all their force, and striking in a desperate manner against each other, seem determined upon death or victory. This combat continues till one of them is defeated or flies; and it often happens that the victor is obliged to fight several of those battles before it remains undisputed master of the field. The old ones are generally the conquerors upon these occasions, as they have more strength and greater courage; and these also are preferred by the hind to the young ones, as the latter are more feeble, and less ardent. However, they are all equally inconstant, keeping to the female but a few days, and then seeking out for another, not to be enjoyed, perhaps, without a repetition of their former danger.

---

[1] Buffon, vol. xi. p. 113.

[2] Mr Buffon has supposed something like this. Vide passim.

In this manner the stag continues to range from one to the other for about three weeks, the time the rut continues: during which he scarcely eats, sleeps, or rests, but continues to pursue, to combat, and to enjoy. At the end of this period of madness, for such in this animal it seems to be, the creature that was before fat, sleek, and glossy, becomes lean, feeble, and timid. He then retires from the herd to seek plenty and repose; he frequents the side of the forest, and chooses the most nourishing pastures, remaining there till his strength is renewed. Thus is his whole life passed in the alternations of plenty and want, of corpulence and inanition, of health and sickness, without having his constitution much affected by the violence of the change. As he is above five years coming to perfection, he lives about forty years; and it is a general rule, that every animal lives about seven or eight times the number of years which it continues to grow. What, therefore, is reported concerning the life of this animal, has arisen from the credulity of ignorance: some say, that a stag having been taken in France, with a collar, on which were written these words, "*Cæsar hoc me donavit*," this was interpreted of Julius Cæsar; but it is not considered that Cæsar is a general name for kings, and that one of the emperors of Germany, who are always styled Cæsars, might have ordered the inscription.

This animal may differ in the term of his life according to the goodness of his pasture, or the undisturbed repose he happens to enjoy. These are the advantages that influence not only his age, but his size and his vigour. The stags of the plains, the valleys, and the little hills, which abound in corn and pasture, are much more corpulent and much taller than such as are bred on the rocky waste, or the heathy mountain. The latter are low, small, and meagre, incapable of going so swift as the former, although they are found to hold out much longer. They are also more artful in evading the hunters; their horns are generally black and short, while those of the lowland stags are reddish and flourishing; so that the animal seems to increase in beauty and stature in proportion to the goodness of the pasture, which he enjoys in security.

The usual colour of the stag in England was red; nevertheless, the greater number in other countries are brown. There are some few that are white; but these seem to have obtained this colour in a former state of domestic tameness. Of all the animals that are natives of this climate, there are none that have such a beautiful eye as the stag; it is sparkling, soft, and sensible. His senses of smelling and hearing are in no less perfection. When he is in the least alarmed, he lifts the head and erects the ears, standing for a few minutes as if in a listening posture. Whenever he ventures upon some unknown ground, or quits his native covering, he first stops at the skirt of the plain to examine all around; he next turns against the wind, to examine by the smell if there be any enemy approaching. If a person should happen to whistle or call out, at a distance, the stag is seen to stop short in his slow-measured pace, and gazes upon the stranger with a kind of awkward admiration; if the cunning animal perceives neither dogs nor fire-arms preparing against him, he goes forward, quite unconcerned, and slowly proceeds without offering to fly. Man is not the enemy he is most afraid of; on the contrary, he seems to be delighted with the sound of the shepherd's pipe; and the hunter sometimes makes use of that instrument to allure the poor animal to his destruction.

The stag eats slowly, and is very delicate in the choice of his pasture. When he has eaten a sufficiency, he then retires to the covert of some thicket to chew the cud in security. His rumination, however, seems performed with much greater difficulty than with the cow or sheep: for the grass is not returned from the first stomach without much straining, and a kind of hiccup, which is easily perceived during the whole time it continues. This may proceed from the greater length of his neck, and the narrowness of the passage, all those of the cow and the sheep kind having it much wider.

This animal's voice is much stronger, louder, and more tremulous, in proportion as he advances in age; in the time of rut it is even terrible. At that season he seems so transported with passion, that nothing obstructs his fury; and, when at bay, he keeps the dogs off with great intrepidity. Some years ago, William Duke of Cumberland caused a tiger and a stag to be enclosed in the same area; and the stag made so bold a defence that the tiger was at last obliged to fly. The stag seldom drinks in the winter, and still less in the spring, while the plants are tender and covered over with dew. It is in the heat of summer, and during the time of rut, that he is seen constantly frequenting the sides of rivers and lakes, as well to slake his thirst as to cool his ardour. He swims with great ease and strength, and best at those times when he is fattest, his fat keeping him buoyant, like oil upon the surface of the water. During the time of rut he even ventures out to sea, and swims from one island to another, although there may be some leagues' distance between them.

The cry of the hind, or female, is not so loud as that of the male, and is never excited but by apprehension for herself or her young. It need scarcely be mentioned that she has no horns, or that she is more feeble or unfit for hunting than the male. When once they have conceived, they separate from the males, and then they both herd apart. The time of gestation continues between eight and nine months, and they generally produce but one at a time. Their usual season for bringing forth is about the month of May, or the beginning of June, during which they take great care to hide their young in the most obscure thickets. Nor is the precaution without reason, since almost every creature is then a formidable enemy. The eagle, the falcon, the osprey, the wolf, the dog, and all the rapacious family of the cat kind, are in continual employment to find out her retreat. But, what is more unnatural still, the stag himself is a professed enemy, and she is obliged to use all her arts to conceal her young from him, as from the most dangerous of her pursuers. At this season, therefore, the courage of the male seems transferred to the female; she defends her young against her less formidable opponents by force; and when pursued by the hunter, she ever offers herself, to mislead him from the principal object of her concern. She flies before the hounds for half the day, and then returns to her young, whose life she has thus preserved at the hazard of her own. The *calf*, for so the young of this animal is called, never quits the dam during the whole summer; and in winter, the hind, and all the males under a year old, keep together, and assemble in herds, which are more numerous in proportion as the season is more severe. In the spring they separate; the hinds to bring forth, while none but the year-olds remain together: these animals are, however, in general fond of herding and grazing in company; it is danger or necessity alone that separates them.

The dangers they have to fear from other animals are nothing when compared to those from man. The men of every age and nation have made the chase of the stag one of their most favourite pursuits; and those who first hunted from necessity have continued it for amusement. In our own country, in particular, hunting was ever esteemed as one of the principal diversions of the great.[1] At first, indeed, the beasts of the chase had the whole island for their range, and knew no other limits than those of the ocean.

The Roman jurisprudence, which was formed on the manners of the first ages, established it as a law, that as the natural right of things which have no master belong to the first possessor, wild beasts, birds, and fishes, are the property of whosoever could first take them. But the northern barbarians who overran the Roman empire, bringing with them the strongest relish for this amusement, and being now possessed of more easy means of subsistence from the lands they had conquered, their chiefs and leaders began to appropriate the right of hunting, and, instead of a natural right, to make it a royal one. When the Saxon kings, therefore, had established themselves into a heptarchy, the chases were reserved by each sovereign for his own particular amusement. Hunting and war, in those uncivilized ages, were the only employment of the great. Their active, but uncultivated minds were susceptible of no pleasures but those of a violent kind, such as gave exercise to their bodies, and prevented the uneasiness of thinking. But as the Saxon kings only appropriated those lands to the business of the chase which were unoccupied before, so no individual received any injury. But it was otherwise when the Norman kings were settled upon the throne. The passion for hunting was then carried to an excess, and every civil right was involved in general ruin This ardour for hunting was stronger than the consideration of religion, even in a superstitious age. The village communities, nay, even the most sacred edifices, were thrown down, and all turned into one vast waste, to make room for animals, the object of a lawless tyrant's pleasure. Sanguinary laws were enacted to preserve the game; and, in the reigns of William Rufus and Henry I., it was less criminal to destroy one of the human species than a beast of chase. Thus it continued while the Norman line filled the throne: but when the Saxon line was restored, under Henry II., the rigour of the forest laws was softened. The barons also, for a long time, imitated the encroachments, as well as the amusements, of the monarch; but when property became more equally divided, by the introduction of arts and industry, these extensive hunting grounds became more limited; and as tillage and husbandry increased, the beasts of chase were obliged to give way to others more useful to the community. Those vast tracts of land, before dedicated to hunting, were then contracted; and, in proportion as the useful arts gained ground, they protected and encouraged the labours of the industrious, and repressed the licentiousness of the sportsman. It is, therefore, among the subjects of a despotic government only, that these laws remain in full force—where large wastes lie uncultivated for the purposes of hunting—where the husbandman can find no protection from the invasion of his lord, or the continual depredations of those animals which he makes the objects of his pleasure.

---

[1] British Zoology.

In the present cultivated state of this country, therefore, the stag is unknown in its wild, natural state; and such of them as remain among us are kept, under the name of *red deer*, in parks among the fallow-deer. But they are become less common than formerly; its excessive viciousness during the rutting-season, and the badness of its flesh, inducing most people to part with the species. The few that still remain wild are to be found on the moors that border on Cornwall and Devonshire; and in Ireland, on most of the large mountains of that country.[1]

In England, the hunting the stag and the buck are performed in the same manner; the animal is driven from some gentleman's park, and then hunted through the open country. But those who pursue the wild animal have a much higher object, as well as a greater variety in the chase. To let loose a creature that was already in our possession, in order to catch it again, is, in my opinion, but a poor pursuit, as the reward, when obtained, is only what we before had given away. But to pursue an animal that owns no proprietor, and which he that first seizes may be said to possess, has something in it that seems at least more rational; this rewards the hunter for his toil, and seems to repay his industry. Besides, the superior strength and swiftness of the wild animal prolongs the amusement; it is possessed of more various arts to escape the hunter, and leads him to precipices where the danger ennobles the chase. In pursuing the animal let loose from a park, as it is unused

---

[1] There can be little doubt that at one period of its history, probably when the surface, which is now morass or peat bog, or cleared and under tillage, was covered with forests, deer were abundant in most parts of Scotland. There was then, probably, a variety which is now extinct, for, in some of the bogs, horns are found of larger dimensions than any that are to be seen upon the present fallow deer, or the red deer of the mountains. The red deer are now far from numerous, and are seldom, if ever, seen on the Grampians. This has, no doubt, arisen from the grazing of sheep and cattle, by which the seclusion the red deer are so fond of has been broken in upon, both in the mountains and in the valleys. As the more lucrative occupation of the soil extends into the remoter districts, the race must further and further decrease; nor is the period at which they will be wholly extinct, in all probability, very distant. Red deer are yet found in Mar forest and Glenartney; and there are still a considerable number in the west parts of Ross and Sutherland; though the extensive and judicious improvements which, very much to the general advantage of the country, have recently been effected, under the Marquis of Stafford, have made them more rare than they were about the end of the last century. Now, unless by a person whom long observation has rendered familiar with their haunts, the country may be traversed without seeing even one. From their fleetness, and the nature of the ground on which they are found, horses and hounds are of no use in the direct chase of them, as the steed would be required to leap precipices of fifty feet, instead of gates of five bars; and the dogs would be constantly tumbling into gullies and ravines, which are cleared by the deer at one bound. They cannot be driven "with hound and horn," as was the case in the days of the "barons bold;" neither can they be collected and hemmed in, after the somewhat similar manner in which the Highland chiefs conducted their sports. Still there are a few places where a person who has been habituated to the occupation, and who does not fear to ground himself in a morass, and will submit to the other pleasures of "stalking," may occasionally find a roe. The most certain time is when the state of the weather is such as to force the herds to the well-heads, where there is brushwood near to cover the marksman.

The largest forest set apart for red deer which exists in Scotland is the forest of Athol, where a hundred thousand English acres are given up to them; and upon this large tract neither man, woman, child, sheep, or oxen, are allowed to trespass, with the exception of those parties who are permitted to partake of the mysteries of deer stalking. The sportsmen, seldom more than two in each party, set forth accompanied by a keeper who acts as general; and they are followed by two or three Highlanders, carrying spare rifles and leading the deer-hounds. The party is preceded by the keeper, who is about twenty or thirty yards in advance, attentively examining the face of every hill with his telescope, to discover the deer that may be grazing upon it. Upon detecting a herd, a council of war is held, and the plan of operations determined upon. It is necessary to proceed with much caution, as, independent of the strong sense of smelling, seeing, and hearing, which these animals are endued with, there is always one of the herd, generally a hind, or female deer, stationed as sentinel; and upon the least suspicion being excited the signal is given, and they are off. Great care is therefore taken in the approach to advance up the wind, and to conceal the party by taking advantage of the inequalities of the ground, preserving the strictest silence. It frequently happens that the sportsmen are obliged to make a circuit of some miles to get near them undetected; at other times they may find that they are in a situation from which they cannot extricate themselves unseen; in that case they must lie down till the herd move into a more favourable position for their purpose. Having arrived as near to them as is possible without detection, the sportsmen, after a careful examination of their rifles, still concealing themselves as much as possible, fire, and continue firing and loading as long as they remain within practicable distance. Eleven out of a herd of fifteen have been known to be killed by one person: the accidental circumstance of an echo, the sound being heard on one side and the flash appearing on the other, so puzzled the deer that they stood still to danger, it is but little versed in the stratagems of escape; the hunter follows as sure of overcoming, and feels none of those alternations of hope and fear which arises from the uncertainty of success. But it is otherwise with the mountain stag: having spent his whole life in a state of continual apprehension—having frequently been followed, and as frequently escaped, he knows every trick to mislead, to confound, or intimidate his pursuers—to stimulate their ardour, and enhance their success.

Those who hunt this animal have their peculiar terms for the different objects of their pursuit. The professors in every art take a pleasure in thus employing a language known only to themselves, and thus accumulate words which to the ignorant have the appearance of knowledge. In this manner, the stag is called the first year, a *calf*, or *hind calf;* the second, a *knobber;* the third, a *brock;* the fourth a *staggard;* the fifth, a *stay;* the sixth, a *hart*. The female is called a *hind;* the first year she is a *calf;* the second, a *hearse;* the third a *hind*. This animal is said to *harbour* in the place where he resides. When he cries, he is said to *bell;* the print of his hoof is called the *slot;* his tail is called the *single;* his excrement the

---

till the four last gathered courage and made off. When wounded, large hounds, of a breed between the greyhound and the bloodhound, are let loose upon the tract of their blood, and they never leave it till they have brought the animal to bay, generally in some stream, where they keep him till the sportsman comes up and despatches him by shooting him through the head. It is necessary for the hunter to be very cautious in approaching him when at bay, and always to keep him down the stream from where he stands; for, if he breaks his bay, he is very likely to attack his pursuer, gore him with his horns, or trample him to pieces with his feet. This is of all European sports, the most noble and interesting, as any person who has tried and understands it will testify, heightened as it is by the wildness and beauty of the scenery, the pure invigorating effect of the mountain air, the picturesque dress and appearance of the Highlanders, and the eager interest they take in a pursuit so peculiar to their own hills and so congenial to their habits.

Fallow deer are much more abundant in Scotland, not only in enclosed parks, but, at large, over the country. They are found in many of the lowland plantations in Forfar and Perthshire; which seems to indicate that a restoration of the woods would lead to an increase of their numbers. Those that are found in the situations alluded to, have, no doubt, been produced by individuals which had escaped from the parks. In summer they are not often seen; but when the winter is severe, they sometimes invade the cottage gardens, in troops of six or eight together.

In a state approaching that of nature they are most plentiful in the central part of the Grampians, from which it is probable that they may extend their numbers into all those mountain districts, where planting has been preferred to grazing. They are most numerous on the southern part of the bleak, and, generally speaking, naked ridge of Minigny, which lies between the glen of Athol on the south, and Badenoch on the north; and between the lofty summits of Ben-y-glac on the east, and the pass of Dalnavardoch on the west. The greater part of this ridge is the property of the Duke of Athol, although many deer are found on the lands of the Duke of Gordon and others, towards the east. The deer are seldom on the summits; but generally in the glens of the Tilt and Bruar. Those deer are often seen in herds of upwards of a thousand; and when, in a tract where there is no human abode for twenty or thirty miles, a long line of bucks appears on a height, with their branching horns relieved upon the clear mountain sky, the sight is very imposing. During the rutting season, the deer are in the fastnesses of the glens; and though they are there more frequently heard, they are not so numerously seen as in their milder moods.

About forty years ago, the deer in the woods of Aboyne, Abergeldie, and other places farther up the Dee, entirely deserted their native grounds, and overran the upper part of Kincardineshire. They seemed to have been smitten with the mania of emigration, or rather with a conqueror-like thirst for destruction, and, like the Egyptian locusts, they ate up every green thing. Their inroads were mostly confined to the parishes of Strachen and Birse, where but very few of their species had latterly existed. It was a season of glory to the landed proprietors, but not so far for their tenants; the deer, although harassed by countless troops of hunters and hounds, still adhered pertinaciously to their chosen points of location, and although scores were slain daily, their numbers were in no sensible degree diminished. The gentlemen at last found that, although they could procure venison in abundance, they could gather no rent for the produce of all their farms had been almost wholly destroyed by that persevering army. The occurrence, which at its commencement they had joyfully hailed, began to assume a very serious aspect; and they forthwith issued a notification, that such of their tenants as chose to take out the sportsman's licence, should have full liberty to kill and destroy as many deer as he chose or could.

The terms were accepted without hesitation: every old musket and fowlingpiece in the country was speedily furbished up, and for weeks the air rung, from dawn till the fall of evening, with the scattered yell of those deadly tubes. It seemed as if broken portions of two adverse armies had met on every hill and in every dingle. The spade and the hoe were cast aside, as if for ever—the plough and the car lay with gaping seams in the sun—the bullock and the draught horse roamed about in the full enjoyment of liberty, getting fat and frolicsome without let or hinderance. Venison became a perfect drug in the market; the meanest citizen turned up his nose at it. You might have had the carcase of a "stag of ten" for half a crown, and the beautiful skin and antlers for nothing. The rafters of the farm houses resembled those of a Westphalia smoking barn, so heavily were they loaded with hinder legs and saddles of venison. The dogs also had a rare time of it; for many a stately creature, on receiving his death wound, crept into a quiet place, and died, without being once looked after. The herds were at last thinned to some purpose, yet they showed no inclination to retreat. They seemed to have made up their minds never to return to their own woods and glens, and sternly did they adhere to the resolution. At last nothing was left of their once formidable array save a few straggling individuals, who, it might have been thought, would soon perish of utter loneliness and heart-breaking defeat. But the peasantry had now so fully entered into the spirit of the thing, that, while a single excuse remained for being abroad in their hunting gear, they were determined to make full use of it; and the war of extermination was keenly maintained, until the last lingering remnant had totally disappeared.

fumet; his horns are called his *head;* when simple, the first year they are called *broches;* the third year, *spears;* the fourth year that part which bears the antlers is called the *beam*, and the little impression upon its surface, *glitters;* those which rise from the crust of the beam are called *pearls*. The antlers also have distinct names; the first that branches off is called the *antler;* the second the *sarantler;* all the rest which grow afterwards, till you come to the top, which is called the *crown*, are called *royal-antlers;* the little buds about the tops are called *croches*. The impression on the place where the stag has lain, is called the *layer*. If it be in covert or thicket, it is called his *harbour*. When a deer has passed into a thicket, leaving marks whereby his bulk may be guessed, it is called an *entry*. When they cast their heads, they are said to *mew*. When they rub their heads against trees, to bring off the peel of their horns, they are said to *fray*. When a stag hard hunted takes to swimming in the water, he is said to *go sail;* when he turns his head against the hounds, he is said to *bay;* and when the hounds pursue upon the scent, until they have unharboured the stag, they are said to *draw the slot*.

Such are but few of the many terms used by hunters in pursuing of the stag, most of which are now laid aside, or in use only among game-keepers. The chase, however, is continued in many parts of the country where the red deer is preserved, and still makes the amusement of such as have not found out more liberal entertainments. In those few places where the animal is perfectly wild, the amusement, as was said above, is superior. The first great care of the hunter, when he leads out his hounds to the mountain side, where the deer are generally known to harbour, is to make choice of a proper stag to pursue. His ambition is to unharbour the largest and the boldest of the whole herd; and for this purpose he examines the track, if there be any, which if he finds long and large, he concludes that it must have belonged to a stag, and not a hind, the print of whose foot is rounder. Those marks also which he leaves on trees, by the rubbing of his horns, show his size, and point him out as the proper object of pursuit. Now to seek out a stag in his haunt, it is to be observed, that he changes his manner of feeding every month. From the conclusion of rutting time, which is in November, he feeds on heaths and broomy places. In December, they herd together, and withdraw into the strength of the forests, to shelter themselves from the severer weather, feeding on holm, elder-trees, and brambles. The three following months they leave herding, but keep four or five in a company, and venture out to the corners of the forest, where they feed on winter pasture, sometimes making their incursions into the neighbouring corn-fields, to feed upon the tender shoots, just as they peep above ground. In April and May, they rest in thickets and shady places, and seldom venture forth unless roused by approaching danger. In September and October, their annual ardour returns; and then they leave the thickets, boldly facing every danger, without any certain place for food or harbour. When, by a knowledge of these circumstances, the hunter has found out the residence, and the quality of his game, his next care is to uncouple and cast off his hounds in the pursuit; these no sooner perceive the timorous animal that flies before them, but they altogether open in full cry, pursuing rather by the scent than the view, encouraging each other to continue the chase, and tracing the flying animal with the most amazing sagacity. The hunters also are not less ardent in their speed on horseback, cheering up the dogs, and directing them where to pursue. On the other hand, the stag, when unharboured, flies at first with the swiftness of the wind, leaving his pursuers several miles in the rear; and at length having gained his former coverts, and no longer hearing the cries of the dogs and men that he had just left behind, he stops, gazes round him, and seems to recover his natural tranquillity. But this calm is of short duration, for his inveterate pursuers slowly and securely trace him along, and he once more hears the approaching destruction from behind. He again, therefore, renews his efforts to escape, and again leaves his pursuers at almost the former distance; but this second effort makes him more feeble than before, and when they come up a second time, he is unable to outstrip them with equal velocity. The poor animal now, therefore, is obliged to have recourse to all his little arts of escape, which sometimes, though but seldom, avail him. In proportion as his strength fails him, the ardour of his pursuers is inflamed; he tracks more heavily on the ground, and this increasing the strength of the scent, redoubles the cries of the hounds, and enforces their speed. It is then that the stag seeks for refuge among the herd, and tries every artifice to put off some other head for his own. Sometimes he will send forth some little deer in his stead, in the meantime lying close himself that the hounds may overshoot him. He will break into one thicket after another, to find deer, rousing them, gathering them together, and endeavouring to put them upon the tracks he has made. His old companions however, with a true spirit of ingratitude, now all forsake and shun him with the most watchful industry, leaving the unhappy creature to take his fate by himself. Thus abandoned of his fellows, he again tries other arts, by doubling and crossing in some hardbeaten highway, where the scent is least perceivable. He now also runs against the wind, not only to cool himself, but the better to hear the voice, and judge of the distance of his implacable pursuers. It is now easily perceivable how sorely he is pressed, by his manner of running, which from the bounding easy pace with which he began, is converted into a stiff and short manner of going; his mouth also is black and dry, without foam on it; his tongue hangs out; and the tears, as some say, are seen starting from his eyes. His, last refuge, when every other method of safety has failed him, is to take the water, and to attempt an escape by crossing whatever lake or river he happens to approach. While swimming, he takes all possible care to keep in the middle of the stream, lest by touching the bough of a tree or the herbage on the banks, he may give scent to the hounds. He is also ever found to swim against the stream; whence the huntsmen have made it into a kind of proverb, *That he that would his chase find, must up with the river, and down with the wind.* On this occasion too he will often cover himself under water so as to show nothing but the tip of his nose. Every resource and every art being at length exhausted, the poor creature tries the last remains of his strength, by boldly opposing those enemies he cannot escape; he therefore faces the dogs and men, threatens with his horns, guards himself on every side, and for some time stands at bay. In this manner, quite desperate, he furiously aims at the first dog or man that approaches, and it often happens that he does not die unrevenged.[1] At that time, the more prudent both of the dogs and men, seem willing to avoid him; but the whole pack quickly coming up, he is soon surrounded and brought down, and the huntsman winds a *treble mort*, as it is called, with his horn.

Such is the manner of pursuing this animal in England; but every country has a peculiar method of its own, adapted either to the nature of the climate, or the face of the soil. The ancient manner was very different from that practised at present; they used their dogs only to find out the game, but not to rouse it. Hence they were not curious as to the music of their hounds, or the composition of their pack; the dog that opened before he had discovered his game, was held in no estimation. It was their usual manner silently to find out the animal's retreat, and surround it with nets and engines, then to drive him up with all their cries, and thus force him into the toils which they had previously prepared. In succeeding times the fashion seemed to alter; and particularly in Sicily, the manner of hunting was as follows. The nobles and gentry being informed which way a herd of deer passed, gave notice to one another, and appointed a day of hunting. For this purpose, every one was to bring a cross-bow, or a long-bow, and a bundle of staves shod with iron, the heads bored, with a cord passing through them all. Thus provided, they came to where the herd continued grazing, and casting themselves about in a large ring, surrounded the deer on every side. Then each taking his stand, unbound his fagot, set up his stake, and tied the end of the cord to that of his next neighbour, at the distance of about ten feet one from the other. Between each of these stakes was hung a bunch of crimson feathers, and so disposed, that with the least breath of wind they would whirl round, and preserve a sort of fluttering motion. This done, the persons who set up the staves withdrew, and hid themselves in the neighbouring coverts; then the chief huntsman, entering with his hounds within the lines, roused the game with a full cry. The deer frighted and flying on all sides, upon approaching the lines, were scared away by the fluttering of the feathers, and wandered about within this artificial paling, still awed by the shining and fluttering plumage that encircled their retreat; the huntsman, however, still pursuing, and calling every person by name, as he passed by their stand, commanded him to shoot the first, third, or sixth, as he pleased: and if any of them missed, or singled out another than that assigned him, it was considered as a most shameful mischance. In this manner, however, the whole herd was at last destroyed; and the day concluded with mirth and feasting.[2]

The stags of China are of a particular kind, for they are no taller than a common house-dog; and hunting them is one of the principal diversions of the great. Their flesh while young is exceedingly good: but when they arrive at maturity, it begins to grow hard and tough: however, the tongue, the muzzle, and the ears, are in particular esteem among that luxurious people. Their manner of taking them is singular enough: they carry with them the heads of some of the females stuffed, and learn exactly to imitate their cry; upon this the male does not fail to appear, and looking on all sides, perceives the head, which is all that the hunter, who is himself concealed, discovers. Upon their nearer approach, the whole company rise, surround, and often take him alive.

---

[1] A wound from a stag's horn was deemed poisonous by our ancestors, as the old rhyme testifies:

> If thou be hurt with hart it brings thee to thy bier.
> But barber's hand will boar's hurt heal, thereof thou needest not fear.

[2] Pier. Hieroglyph. lib. vii. cap. 6.

There are very few varieties in the red deer of this country; and they are mostly found of the same size and colour. But it is otherwise in different parts of the world, where they are seen to differ in form, in size, in horns, and in colour.[1]

The stag of Corsica is a very small animal, being not above half the size of those common among us. His body is short and thick, his legs short, and his hair of a dark brown.

There is, in the forests of Germany, a kind of stag, named by the ancients the *Tragelaphus*, and which the natives call the *bran deer*, or the *brown deer*. This is of a darker colour than the common stag, of a lighter shade upon the belly, long hair upon the neck and throat by which it appears bearded like the goat.

There is also a very beautiful stag, which by some is said to be a native of Sardinia; but others, among whom is Mr Buffon, are of opinion that it comes from Africa, or the East Indies. He calls it the *axis*, after Pliny; and considers it as making the shade between the stag and the fallow-deer. The horns of the axis are round, like those of the stag; but the form of its body entirely resembles that of the buck, and the size also is exactly the same. The hair is of four colours; namely, sallow, white, black, and gray. The white is predominant under the belly, on the inside of the thighs,

---

[1] Far removed from the rein-deer and other northern species of the genus in character and general appearance, the Axis forms the type of a tribe of deer, inhabiting the warmer climates of Eastern Asia, and distinguished by the peculiar conformation of their horns. These appendages, in all the species of the axis or rusa tribe, are in their adult state furnished with no more than two simple branches or snags, the one originating from the stem near its base, and the other taking its rise considerably above the middle and forming with the continuation of the stem a kind of terminal bifurcation. The horns themselves are either perfectly sessile, or elevated only on short cylindrical processes. Notwithstanding their simplicity and the general uniformity of their character, they are subject to no little variation in the comparative size, length, and direction of their ramifications; and numerous species have been founded by authors, and in particular by M. Cuvier and M. Blainville, on the most trifling modifications in these particulars.

The axis deer is the earliest and best known species of the Indian group. In size, form, and the general distribution of its colours, it is extremely similar to the fallow-deer of Europe, with which it has frequently been compared. So close indeed is the resemblance, that it is sometimes difficult to distinguish between the females of the two races in their summer coat without a minute comparison. In the males the horns alone afford at the first glance a clear and unequivocal mark of distinction. These organs rise almost vertically from the head, take a slight curvature outwards, and turn a little forwards and inwards at their points. The lowermost antler or snag rises close to the base on the anterior surface, and is directed forwards and upwards; the upper takes its origin above the middle and from the inner side. The stems and their branches are perfectly cylindrical throughout, with a somewhat rugged and tubercular surface; and they never form the flattened and palmated expansions which distinguish those of the fallow-deer.

To the observations of M. G. Cuvier in the Paris Menagerie we owe an extended comparison between the axis and spotted individuals of the fallow-deer. In both, the colour of the back and sides is fawn spotted with white; a deep brown or blackish band occupies the middle line of the back; and an almost continuous white line passes along either side of the belly between the limbs. But the head, which in the fallow-deer is of a uniform grayish brown, is marked in the axis by a broad dusky spot on the forehead, and a line of the same colour extending along the middle of the nose. The chin and throat of the axis are pure white, while in the fallow-deer they are of nearly the same colour with the chest and under surface of the body, which are both of a grayish hue. The buttocks of the fallow-deer are occupied by a broad white patch, separated from the fawn of the back and sides by a black band; and the tail is black above and white beneath. In the axis the buttocks are of the same colour with the adjacent parts, and the tail is tawny above and white beneath, with a narrow blackish border towards the tip.

Such are the principal differences in colour between the most nearly approximating individuals of the two species; but it is only during the summer that any similarity exists, for the fallow-deer changes in winter to a uniform brown, while the axis retains its spotted livery throughout the year. In form the most remarkable distinctions consist in the rather larger size of the axis; in the somewhat more elongated and pointed shape of its head; and in the suborbital fissures, which are of large size in the fallow-deer, and are of little depth in the Indian species, in which their place is strongly marked by a patch of reddish hairs.

The axis appears to be common in India and the larger islands of the Indian archipelago, but is most abundant in Bengal and on the banks of the Ganges. There can be little doubt that it is the animal mentioned by Pliny, under the name which was adopted from him by Belon, and employed for it by all subsequent writers. Considerable numbers have been brought to England during the last century, and have thriven extremely well in the menageries, and occasionally in open parks, propagating freely in captivity. It is even stated, on the authority of Peter Collinson, that a mixed progeny has been obtained between them and the fallow-deer. They are singularly mild and quiet in their disposition; but their gentleness is not unmixed with timidity, which often degenerates into suspicion. Pennant observes that their sense of smell is so acute that, although fond of bread, which they readily take from the hands of visiters, they will not touch it, if it have been previously blown upon; and M. F. Cuvier tells us that they will not even accept it, if it have been much handled. This extreme sensibility of smell and squeamishness of palate is not, however, we may remark, confined to the axis, but is common to the whole of the deer and of the antelopes also.—*Gardens and Menagerie of the Zool. Soc. vol. I.*

and the legs. Along the back there are two rows of spots in a right line; but those on other parts of the body are very irregular. A white line runs along each side of this animal, while the head and neck are gray. The tail is black above, and white beneath; and the hair upon it is six inches long.

Although there are but few individuals of the deer kind, yet the race seems diffused over all parts of the earth. The new continent of America, in which neither the sheep, the goat, nor the gazelle, have been originally bred, nevertheless produces stags, and other animals of the deer kind, in sufficient plenty. The Mexicans have a breed of white stags in their parks, which they call *stags royal*.[1] The stags of Canada differ from ours in nothing except the size of the horns, which in them is greater; and the direction of the antlers, which rather turn back, than project forward, as in those of Europe.[2] The same difference of size that obtains among our stags is also to be seen in that country; and, as we are informed by Ruysch, the Americans have brought them into the same state of domestic tameness that we have our sheep, goats, or black cattle. They send them forth in the day-time to feed in the forests; and at night they return home with the herdsman who guards them. The inhabitants have no other milk but what the hind produces; and use no other cheese but what is made from thence. In this manner we find, that an animal which seems made only for man's amusement, may be easily brought to supply his necessities. Nature has many stores of happiness and plenty in reserve, which only want the call of industry to be produced, and now remain as candidates for human approbation.[3]

THE FALLOW-DEER.[4]

No two animals can be more nearly allied than the stag and the fallow-deer.[5] Alike in form, alike in disposition, in the superb furniture of their heads, in their swiftness and timidity; and yet no two animals keep more distinct, or avoid each other with more fixed animosity. They are never seen to herd in the same place, they never engender together, or form a mixed breed; and even in those countries where the stag is common, the buck seems to be entirely a stranger; in short, they both form distinct families; which, though so seemingly near, are still remote; and although with the same habitudes, yet retain an unalterable aversion. The fallow-deer, as they are much smaller, so they seem of a nature less robust, and less savage than those of the stag kind. They are found but rarely wild in the forests; they are, in general, bred up in parks, and kept for the purposes of hunting, or of luxury, their flesh being preferred to that of any other animal. It need scarcely be mentioned, that the horns of the buck make its principal distinction, being broad and palmated; whereas those of the stag are in every part round. In the one, they are flattened and spread like the palm of the hand; in the other, they grow like a tree, every branch being of the shape of the stem that bears it. The fallow-deer also has the tail longer, and the hair lighter, than the stag; in other respects, they pretty nearly resemble one another.

The head of the buck, as of all other animals of this kind, is shed every year, and takes the usual time for repairing. The only difference between it and the stag is that this change happens later in the buck; and its rutting-time consequently falls more into the winter. It is not found so furious at this season as the former; nor does it so much exhaust itself by the violence of its ardour. It does not quit its natural pastures in quest of the female, nor does it attack other animals with indiscriminate ferocity: however, the males combat for the female among each other; and it is not without many contests that one buck is seen to become master of the whole herd. It often happens also that a herd of fallow-deer is seen to divide into two parties, and engage each other with great ardour and obstinacy.[6] They doth seem desirous of gaining some favourite spot of the park for pasture, and of driving the vanquished party into the coarser and more disagreeable parts. Each of these factions has its particular chief; namely, the two oldest and strongest of the herd. These lead on to the engagement; and the rest follow under their direction. These combats are singular enough, from the disposition and conduct which seems to regulate their mutual efforts. They attack with order, and support the assault with courage; they come to each other's assistance, they retire, they rally, and never give up the victory upon a single defeat. The combat is renewed for several days together; until at length the most feeble side is obliged to give way, and is content to escape to the most disagreeable parts of the park, where only they can find safety and protection.

---

[1] Buffon, vol. xii. p. 35.

[2] The *wapiti* is a stag of North America, and resembles the common stag in nearly all his proportions, but his size is far superior, being at the shoulder from four feet four to four feet eight inches: the superiority of bulk appearing chiefly in the magnitude of the body.

[3] In the mountainous parts of Hircania, Russia, and Siberia, is found a species of deer something larger than the roe-buck. The colour is brown, with the outsides of the limbs and under parts of the body yellowish. The hinder parts of the thighs are white, forming a large patch on the back of the animal. The space round the nose and sides of the lower lip are black, but the tip of the lip is white. It has no tail, but a mere broadish excrescence.

[4] The fallow-deer is smaller than the stag; of a brownish bay colour: whitish beneath, on the insides of the limbs, and beneath the tail. The horns, which are peculiar to the male, are very different from those of the stag; they are not properly branched, but are broader towards the upper part, and divided into processes down the outside. A simple antler rises from the base of each, and a similar one at some distance from the first.

[5] Buffon, vol. xii. p. 36.

[6] Buffon, vol. xii. p. 36.

The fallow-deer is easily tamed, and feeds upon many things which the stag refuses. By this means it preserves its venison better; and even after rutting it does not appear entirely exhausted. It continues almost in the same state through the whole year, although there are particular seasons when its flesh is chiefly in esteem. This animal also browses closer than the stag; for which reason it is more prejudicial among young trees, which it often strips too close for recovery. The young deer eat much faster, and more greedily than the old; they seek the female at their second year; and, like the stag, are fond of variety. The doe goes with young about eight months, like the hind; and commonly brings forth one at a time; but they differ in this, that the buck comes to perfection at three, and lives till sixteen; whereas the stag does not come to perfection till seven, and lives till forty.[1]

As this animal is a beast of chase, like the stag, so the hunters have invented a number of names relative to him. The buck is the first year called a *fawn;* the second, a *pricket;* the third a *sorel;* the fourth, a *sore;* the fifth, a *buck of the first head;* and the sixth, a *great buck.* The female is called a *doe;* the first year a *fawn;* and the second a *tegg.* The manner of hunting the buck is pretty much the same as that of stag-hunting, except that less skill is required in the latter. The buck is more easily roused; it is sufficient to judge by the view, and mark what grove or covert it enters, as it is not known to wander far from thence; nor, like the stag, to change its *layer*, or place of repose. When hard hunted, it takes to some stronghold, or covert, with which it is acquainted, in the more gloomy parts of the wood, or the steeps of the mountain; not, like the stag, flying far before the hounds, nor crossing, nor doubling, nor using any of the subtleties which the stag is accustomed to. It will take the water when sorely pressed, but seldom a great river; nor can it swim so long nor so swiftly as the former. In general, the strength, the cunning, and the courage of this animal, are inferior to those of the stag; and consequently it affords neither so long, so various, nor so obstinate a chase: besides being lighter and not tracking so deeply, it leaves a less powerful and lasting scent, and the dogs in the pursuit are more frequently at a fault.

As the buck is a more delicate animal than the stag, so also is it subject to greater varieties.[2] We have in England two varieties of the fallow deer, which are said to be of foreign origin: the beautiful spotted kind, which is supposed to have been brought from Bengal; and the very deep brown sort that are now so common in several parts of this kingdom. These were introduced by King James the First from Norway: for having observed their hardiness, and that they could endure the winter, even in that severe climate, without fodder, he brought over some of them into Scotland, and disposed of them among his chases. Since that time they have multiplied in many parts of the British empire; and England is now become more famous for its venison than any other country in the world. Whatever pains the French have taken to rival us in this particular, the flesh of their fallow-deer, of which they keep but a few, has neither the fatness nor the flavour of that fed upon English pasture.

However, there is scarcely a country in Europe, except far to the northward, in which this animal is a stranger. The Spanish fallow-deer are as large as stags, but of a darker colour, and a more slender neck: their tails are longer than those of ours, they are black above, and white below. The Virginian deer are larger and stronger than ours, with great necks, and their colour inclinable to gray. Other kinds have the hoofs of their hind-legs marked outwardly with a white spot; and their ears and tail much longer than the common. One of these has been seen full of white spots, with a black list down the middle of his back. In Guiana, a country of South America, according to Labat, there are deer without horns, which are much less than those of Europe, but resembling them in every other particular. They are very lively, light of course, and excessively fearful; their hair is of a reddish sallow, their heads are small and lean, their ears little, their necks long and arched, the tail short, and the sight piercing. When pursued, they fly into places where no other animal can follow them. The negroes, who pursue them, stand to watch for them in narrow paths, which lead to the brook, or the meadow where they feed; there waiting in the utmost silence, for the slightest sound will drive them away, the negro, when he perceives the animal within reach, shoots, and is happy if he can bring down his game. Their flesh, though seldom fat, is considered as a great delicacy, and the hunter is well rewarded for his trouble.

---

[1] The fallow-deer is known to bring forth from one to three at a time, and lives till about twenty. When these animals drink, they plunge their noses, like some horses, very deep under water, and continue in that situation for some time.

[2] British Zoology.

THE ROE-BUCK.

The roe-buck is the smallest of the deer kind known in our climate, and is now almost extinct among us, except in some parts of the Highlands of Scotland. It is generally about three feet long, and about two feet high. The horns are from eight to nine inches long, upright, round, and divided into only three branches. The body is covered with very long hair, well adapted to the rigour of its mountainous abode. The lower part of each hair is ash-colour; near the ends is a narrow bar of black, and the points are yellow. The hairs on the face are black, tipped with ash colour. The ears are long, their insides of a pale yellow, and covered with long hair. The spaces bordering on the eyes and mouth are black. The chest, belly, and legs, and the inside of the thighs, are of a yellowish white; the rump is of a pure white, and the tail very short.[1] The make of this little animal is very elegant; and its swiftness equals its beauty. It differs from the fallow deer, in having round horns, and not flattened like theirs. It differs from the stag, in its smaller size, and the proportionable paucity of its antlers: and it differs from all of the goat kind, as it annually sheds its head, and obtains a new one, which none of that kind are ever seen to do.

As the stag frequents the thickest forests, and the sides of the highest mountains, the roebuck, with humbler ambition, courts the shady thicket, and the rising slope. Although less in size, and far inferior in strength to the stag, it is yet more beautiful, more active, and even more courageous. Its hair is always smooth, clean, and glossy; and it frequents only the driest places, and of the purest air. Though but a very little animal, as we have already observed, yet when its young is attacked, it faces even the stag himself, and often comes off victorious.[2] All its motions are elegant and easy; it bounds without effort, and continues the course with but little fatigue. It is also possessed of more cunning in avoiding the hunter, is more difficult to pursue; and, although its scent is much stronger than that of the stag, it is more frequently found to make good a retreat. It is not with the roebuck as with the stag, who never offers to use art until his strength is beginning to decline; this more cunning animal, when it finds that its first efforts to escape are without success, returns upon its former track, again goes forward, and again returns, until by its various windings it has entirely confounded the scent, and joined the last emanations to those of its former course. It then by a bound, goes to one side, lies flat upon its belly, and permits the pack to pass by very near, without offering to stir.

But the roebuck differs not only from the stag in superior cunning, but also in its natural appetites, its inclinations, and its whole habits of living. Instead of herding together, these animals live in separate families; the sire, the dam, and the young ones associate together, and never admit a stranger into their little community. All other of the deer kind are inconstant in their affection; but the roebuck never leaves its mate; and, as they have been generally bred up together from their first fawning, they conceive so strong an attachment, the male for the female, that they never after separate. Their rutting season continues but fifteen days; from the latter end of October to about the middle of November. They are not at that time, like the stag, overloaded with fat; they have not that strong odour, which is perceived in all others of the deer kind; they have none of those furious excesses; nothing, in short, that alters their state; they only drive away their fawns upon these occasions; the buck forcing them to retire, in order to make room for a succeeding progeny; however, when the copulating season is over, the fawns return to their does, and remain with them some time longer; after which, they quit them entirely, in order to begin an independent family of their own. The female goes with young but five months and a half, which alone serves to distinguish this animal from all others of the deer kind, that continue pregnant more than eight. In this respect, she rather approaches more nearly to the goat kind; from which, however, this race is separated by the male's annual casting its horns.

---

[1] There are two varieties of colour, one very red, and the other yellowish-brown-gray; there is even a third nearly black, in Hanover, but all have a white disk upon the buttocks.

[2] Buffon, vol xii. p 75.

When the female is ready to bring forth, she seeks a retreat in the thickest part of the woods, being not less apprehensive of the buck, from whom she then separates, than of the wolf, the wild cat, and almost every ravenous animal of the forest; she generally produces two at a time, and three but very rarely. In about ten or twelve days these are able to follow the dam, except in cases of warm pursuit, when their strength is not equal to the fatigue. Upon such occasions, the tenderness of the dam is very extraordinary; leaving them in the deepest thicket, she offers herself to the danger, flies before the hounds, and does all in her power to lead them from the retreat where she has lodged her little ones. Such animals as are nearly upon her own level she boldly encounters; attacks the stag, the wild cat, and even the wolf; and while she has life, continues her efforts to protect her young. Yet all her endeavours are often vain. About the month of May, which is her fawning time, there is a greater destruction among those animals than at any other season of the year. Numbers of the fawns are taken alive by the peasants; numbers are found out, and worried by the dogs; and still more by the wolf, which has always been their most inveterate enemy. By these continual depredations upon this beautiful creature, the roe-buck is every day becoming scarcer; and the whole race in many countries is wholly worn out. They were once common in England; the huntsmen, who characterized only such beasts as they knew, have given names to the different kinds and ages, as to the stag: thus they called it the first year a *hind;* the second, a *gyrle;* and the third, a *hemuse;* but these names at present are utterly useless, since the animal no longer exists among us. Even in France, where it was once extremely common, it is now confined to a few provinces; and it is probable that in an age or two the whole breed will be utterly extirpated. Mr Buffon, indeed, observes that in those districts where it is mostly found, it seems to maintain its usual plenty, and that the balance between its destruction and increase is held pretty even: however, the number in general is known to decrease; for wherever cultivation takes place, the beasts of nature are known to retire. Many animals that once flourished in the world may now be extinct; and the descriptions of Aristotle and Pliny, though taken from life, may be considered as fabulous, as their architypes are no longer existing.

The fawns continue to follow the deers eight or nine months in all; and upon separating, their horns begin to appear simple, and without antlers, the first year, as in those of the stag kind.[1] These they shed at the latter end of autumn, and renew during the winter; differing in this from the stag, who sheds them in spring, and renews them in summer. When the roe-buck's head is completely furnished, it rubs the horns against the trees in the manner of the stag, and thus strips them of the rough skin and the blood-vessels, which no longer contribute to their nourishment and growth. When these fall, and new ones begin to appear, the roe-buck does not retire, as the stag, to the cover of the wood, but continues its usual haunts, only keeping down its head to avoid striking its horns against the branches of trees, the pain of which it seems to feel with exquisite sensibility. The stag, who sheds his horns in summer, is obliged to seek a retreat from the flies, that at that time greatly incommode him; but the roe-buck, who sheds them in winter, is under no such necessity; and, consequently, does not separate from its little family, but keeps with the female all the year round.[2]

As the growth of the roe-buck, and its arrival at maturity, is much speedier than that of the stag, so its life is proportionably shorter. It seldom is found to extend above twelve or fifteen years; and if kept tame, it does not live above six or seven. It is an animal of a very delicate constitution, requiring variety of food, air, and exercise. It must be paired with a female, and kept in a park of at least a hundred acres. They may easily be subdued, but never thoroughly tamed; no arts can teach them to be familiar with the feeder, much less attached to him. They still preserve a part of their natural wildness, and are subject to terrors without a cause. They sometimes, in attempting to escape, strike themselves with such force against the walls of their enclosure that they break their limbs, and become utterly disabled. Whatever care is taken to tame them, they are never entirely to be relied on, as they have capricious fits of fierceness, and sometimes strike at those they dislike with a degree of force that is very dangerous.

The cry of the roe-buck is neither so loud nor so frequent as that of the stag. The young ones have a particular manner of calling to the dam, which the hunters easily imitate, and often thus allure the female to her destruction. Upon some occasions, also, they become in a manner intoxicated with their food, which, during the spring, is said to ferment in their stomachs, and they are then very easily taken. In summer they keep close under covert of the forest, and seldom venture out, except in violent heats, to drink at some river or fountain. In general, however, they are contented to slake their thirst with the dew that falls on the grass and the leaves of trees, and seldom risk their safety to satisfy their appetite. They delight chiefly in hilly grounds, preferring the tender branches and buds of trees to corn and other vegetables; and it is universally allowed that the flesh of those between one and two years old is the greatest delicacy that is known. Perhaps, also, the scarceness of it enhances its flavour.

---

[1] Buffon, vol. xii. p. 83.

[2] Ibid.

In America this animal is much more common than in Europe. With us there are but two known varieties; the red, which is the larger sort; and the brown, with a spot behind, which is less. But in the new continent the breed is extremely numerous, and the varieties in equal proportion. In Louisiana, where they are extremely common, they are much larger than in Europe, and the inhabitants live in a great measure upon its flesh, which tastes like mutton when well fatted. They are found also in Brazil, where they have the name of *cuguacu apara*, only differing from ours in some slight deviations in the horns. This animal is also said to be common in China; although such as have described it seem to confound it with the musk goat, which is of a quite different nature.

THE ELK.[1]

We have hitherto been describing minute animals in comparison of the elk; the size of which, from concurrent testimony, appears to be equal to that of the elephant itself. It is an animal rather of the buck than the stag kind, as its horns are flattened towards the top; but it is far beyond both in stature, some of them being known to be above ten feet high. It is a native both of the old and new continent, being known in Europe under the name of the *elk*, and in America by that of the *moose deer*. It is sometimes taken in the German and Russian forests, although seldom appearing;[2] but it is extremely common in North America, where the natives pursue and track it in the snow. The accounts of this animal are extremely various; some describing it as

---

[1] Among the fossil relics which our British islands afford, none are more interesting than those of a species of elk now extinct, which once abounded in the localities where its remains are discovered.

The bones of the elk occur in the greatest abundance in the bogs and marl-pits of Ireland. They are also found in similar situations in the Isle of Man, as well as in the alluvial strata of England, and have been dug up in France, Germany, and Italy, where, according to Cuvier, they were found in the same strata with bones of elephants. Ireland, however, appears to have been the congenial habitat of this animal. There its remains are, in some districts, so common, that they have ceased to be regarded as *curiosities*, and are either used for any common purpose, or are neglected till they become destroyed.

[2] The elk was at one time numerous in most parts of Sweden and Norway; but owing to the increased population, and other causes, it is now only to be met with in particular districts. In Scania, the most southern province of Sweden, where they once abounded, there are now none to be found. "The elk cannot endure," says Nellsson, a Swedish naturalist, "so cold a climate as the stag, the sixty-fourth degree of latitude being the extreme limit at which he is met with in the Scandinavian peninsula. The elk is sometimes of an enormous size; though his length be not proportionate, it is said, he not unfrequently attains to the height of seven or eight feet. This I can readily believe, as Mr Wise, the Swedish consul-general, had one in his possession a few years ago, which, though only two years of age, measured nearly nineteen hands, or upwards of six feet at the shoulder. I once took the exact dimensions of a rather large male elk that I shot; but, unfortunately, I lost the measuring-string out of my pocket. Though this animal was not fully grown, it was thought he weighed near one thousand pounds. The male is very much larger than the female."

The period of gestation with the elk is about nine months; the female brings forth, about the middle of May, from one to three young ones; it is seldom, however, that she has more than two. At this period, the mother retires alone to the wildest recesses of the forest. After the lapse of two or three days, the fawns, which are of a light brown colour, have sufficient strength to follow their dam everywhere. They keep with her until they are in their third year, when she leaves them to shift for themselves. The elk is a long-lived animal; he does not attain to his full growth until after his fourteenth year: at least, so it is to be presumed, as up to that period his horns, which are of a flat form, are annually provided with an additional branch. He sheds his horns about the month of February in each year. The female elk has no horns.

By nature, the elk is timorous, and he usually flies at the sight of a man. In the rutting season, however, like other animals, he is said to be dangerous. His weapons are his horns and his hoofs: he strikes so forcibly with the latter, as to annihilate a wolf, or other large animal, at a single blow. It is said, that when the elk is incensed, the hair on his neck bristles up like the mane of a lion, which gives him a wild and frightful appearance.

In the summer season, the elk usually resorts to morasses and low situations, for he frequently takes to the water in warm weather; he is an admirable swimmer. In the winter, he retires to the more sheltered parts of the forest, where willow, ash, &c. are to be found; as, from the small boughs of these trees, he obtains his sustenance during that inclement period of the year.

The flesh of the elk is excellent, whether fresh or smoked. Mr Nellsson says it resembles in taste that of the stag. The tongue and the nose are thought to be great delicacies in Scandinavia, as well as in America. Great virtue was once placed in the hoof of the animal.

being no higher than a horse, and others above twelve feet high.

As the stature of this creature makes its chief peculiarity, so it were to be wished that we could come to some precision upon that head. If we were to judge of its size by the horns, which are sometimes fortuitously dug up in many parts of Ireland, we should not be much amiss in ascribing them to an animal at least ten feet high. One of these I have seen, which was ten feet nine inches from one tip to the other. From such dimensions, it is easy to perceive that it required an animal far beyond the size of a horse to support them. To bear a head with such extensive and heavy antlers, required no small degree of strength ; and without all doubt the bulk of the body must have been proportionable to the size of the horns. I remember some years ago to have seen a small moose-deer, which was brought from America by a gentleman of Ireland ; it was about the size of a horse, and the horns were very little larger than those of a common stag : this, therefore, serves to prove that the horns bear an exact proportion to the animal's size ; the small elk has but small horns ; whereas those enormous ones, which we have described above, must have belonged to a proportionable creature. In all the more noble animals, Nature observes a perfect symmetry; and it is not to be supposed she fails in this single instance. We have no reason, therefore, to doubt the accounts of Jocelyn and Dudley, who affirm that they have been found fourteen spans ; which, at nine inches to a span, makes the animal almost eleven feet high. Others have extended their accounts to twelve and fourteen feet, which makes this creature one of the most formidable of the forest.

There is but very little difference between the European elk and the American moose-deer, as they are but varieties of the same animal.[1] It may be rather larger in America than with us; as in the forests of that unpeopled country it receives less disturbance than in our own. In all places, however, it is timorous and gentle; content with its pasture, and never willing to disturb any other animal, when supplied itself. The European elk grows to above seven or eight feet high. In the year 1742, there was a female of this animal shown at Paris, which was caught in a forest of Red Russia, belonging to the Cham of Tartary; it was then but young, and its height was even at that time six feet seven inches; but the describer observes, that it has since become much taller and thicker, so that we may suppose this female at least seven feet high. There have been no late opportunities of seeing the male; but, by the rule of proportion, we may estimate his size at eight or nine feet, at the least, which is about twice as high as an ordinary horse. The height, however,

---

as parings of it were supposed to be a specific against the falling sickness and other disorders; this idle notion is exploded. The skin is convertible to many purposes, and is very valuable. Mr Greiff says—"It is not long since that a regiment was clothed with buff waistcoats made from the hides of those animals, which were so thick, that a ball could scarcely penetrate them." He adds further, that, "when made into breeches, a pair of them, among the peasantry of former days, went as a legacy for several generations." The elk is easily domesticated. Formerly, these animals were made use of in Sweden, to draw sledges.

[1] The moose is the largest of the family of deer, and is particularly characterized by the swelling out and projection of the nostrils, which are divided by a long slit, by the largeness of the ears, by the shortness of the neck, and by the disproportionate height of the legs. The animal when he feeds, is obliged to kneel, or to stretch out his forelegs on either side, to be able to reach the earth with his long and flexible upper lip. This lip is of a size between the lip of the horse and that of the tapir, and through the agency of four pair of strong muscles its power of movement is as various as it is rapid. The difficulty which the animal feels in grazing, causes it to inhabit woods in preference to plains, where it browses upon the leaves and young branches of trees. The muscles of the neck of the moose are of extraordinary thickness, to enable him to carry his enormous horns, which when the animal has reached his sixth year sometimes weigh sixty pounds. To preserve himself from the flies of the forest, which are his great annoyance in summer, the moose plunges into marshes, where he often remains night and day, feeding upon the water-plants, and occasionally lifting his head only above the surface. The North American Indians believe that the moose has the power of remaining entirely under water, as the following extract from Tanner's narrative will show:

"There is an opinion prevalent among the Indians, that the moose, among the methods of self preservation with which he seems better acquainted than almost any other animal, has the power of remaining for a long time under water. Two men of the band of Wa-ge-to-tohgun, whom I knew perfectly well, and considered very good and credible Indians, after a long day's absence on a hunt, came in and stated that they had chased a moose into a small pond, that they had seen him go to the middle of it, and disappear; and then choosing positions, from which they could see every part of the circumference of the pond, smoked and waited until near evening; during all which time they could see no motion of the water or other indication of the position of the moose. At length, being discouraged, they had abandoned all hope of taking him, and returned home. Not long afterwards came a solitary hunter loaded with meat, who related that having followed the track of a moose for some distance, he had traced it to the pond before-mentioned; but having also discovered the tracks of two men, made at the same time as those of the moose, he concluded they must have killed it. Nevertheless, approaching cautiously to the margin of the pond, he sat down to rest. Presently he saw the moose rise slowly in the centre of the pond, which was not very deep, and make towards the shore where he was sitting. When he came sufficiently near, he shot him in the water. The Indians consider the moose shyer and more difficult to take than any other animal. He is more vigilant, and his senses more acute than those of the buffalo or caribou. He is fleeter than the elk, and more prudent and crafty than the antelope."

of the female which was measured, was but six feet seven inches, Paris measure; or almost seven English feet high. It was ten feet from the tip of the nose to the insertion of the tail; and eight feet round the body. The hair was very long and coarse, like that of a wild boar. The ears resembled those of a mule, and were a foot and a half long. The upper jaw was longer by six inches than the lower; and, like other ruminating animals, it had no teeth (cutting-teeth, I suppose the describer means.) It had a large beard under the throat, like a goat; and in the middle of the forehead, between the horns, there was a bone as large as an egg. The nostrils were four inches long on each side of the mouth. It made use of its fore-feet as a defence against its enemies. Those who showed it, asserted that it ran with astonishing swiftness; and that it swam also with equal expedition, and was very fond of the water. They gave it thirty pounds of bread every day, besides hay, and it drank eight buckets of water. It was tame and familiar, and submissive enough to its keeper.

This description differs in many circumstances from that which we have of the moose, or American elk, which the French call the original. Of these there are two kinds, the common light gray moose, which is not very large; and the black moose, which grows to an enormous height. Mr Dudley observes, that a doe or hind of the black moose kind, of the fourth year, wanted but an inch of seven feet high. All, however, of both kinds, have flat palmated horns, not unlike the fallow-deer, only that the palm is much larger, having a short trunk at the head, and then immediately spreading above a foot broad, with a kind of small antlers, like teeth, on one of the edges. In this particular, all of the elk kind agree; as well the European elk, as the gray and the black moose-deer.

The gray moose-deer is about the size of a horse; and although it has large buttocks, its tail is not above an inch long. As in all of this kind the upper lip is much longer than the under, it is said that they continue to go backward as they feed. Their nostrils are so large that a man may thrust his hand in a considerable way; and their horns are as long as those of a stag, but, as was observed, much broader.

The black moose is the enormous animal mentioned above, from eight to twelve feet high. Jocelyn, who is the first English writer that mentions it, says, that it is a goodly creature, twelve feet high, with exceeding fair horns, that have broad palms, two fathoms from the top of one horn to another. He assures us, that it is a creature or rather a monster of superfluity, and many times bigger than an English ox. This account is confirmed by Dudley; but he does not give so great an expansion to the horns, measuring them only thirty-one inches between one tip and the other: however, that such an extraordinary animal as Jocelyn describes, has actually existed, we can make no manner of doubt of, since there are horns common enough to be seen among us, twelve feet from one tip to the other.

These animals delight in cold countries, feeding upon grass in summer, and the bark of trees in winter. When the whole country is deeply covered with snow, the moose-deer herd together under the tall pine trees, strip off the bark, and remain in that part of the forest while it yields them subsistence. It is at that time that the natives prepare to hunt them: and particularly when the sun begins to melt the snow by day, which is frozen again at night; for then the icy crust which covers the surface of the snow, is too weak to support so great a bulk, and only retards the animal's motion. When the Indians therefore perceive a herd of these at a distance, they immediately prepare for their pursuit, which is not, as with us, the sport of an hour, but is attended with toil, difficulty, and danger.[1] The timorous animal no sooner observes its enemies approach, than it immediately endeavours to escape, but sinks at every step it takes. Still, however, it pursues its way through a thousand obstacles: the snow, which is usually four feet deep, yields to its weight, and embarrasses its speed; the sharp ice wounds its feet; and its lofty horns are entangled in the branches of the forest, as it passes along. The trees, however, are broken down with ease; and wherever the moose-deer runs, it is perceived by the snapping of the branches of the trees, as thick as a man's thigh, with its horns. The chase lasts in this manner for the whole day; and sometimes it has been known to continue for two, nay, three days together; for the pursuers are often not less excited by famine, than the pursued by fear. Their perseverance, however, generally succeeds; and the Indian who first comes near enough, darts his lance with unerring aim, which sticks in the poor animal, and at first increases its efforts to escape. In this manner the moose trots heavily on, (for that is its usual pace,) till its pursuers once more come up, and repeat their blow: upon this, it again summons up sufficient vigour to get ahead; but at last, quite tired, and spent with loss of blood, it sinks, as the describer expresses it, like a ruined building, and makes the earth shake beneath its fall.[2]

---

[1] Phil. Trans. vol. ii. p. 436.

[2] It is the habit of deer to frequent the creeks and rivers in the night during the warm months, particular-

This animal, when killed, is a very valuable acquisition to the hunters. The flesh is very well tasted, and said to be very nourishing. The hide is strong, and so thick that it has been often known to turn a musket-ball; however, it is soft and pliable, and, when tanned, the leather is extremely light, yet very lasting. The fur is a light gray in some, and blackish in others; and when viewed through a microscope, appears spongy like a bulrush, and is smaller at the roots and points than in the middle; for this reason, it lies very flat and smooth, and though beaten or abused never so much, it always returns to its former state. The horns also are not less useful, being applied to all the purposes for which hartshorn is beneficial: these are different in different animals; in some they resemble entirely those of the European elk, which spread into a broad palm, with small antlers on one of the edges; in others they have a branched brow-antler between the bur and the palm, which the German elk has not; and in this they entirely agree with those whose horns are so frequently dug up in Ireland. This animal is said to be troubled with the epilepsy, as it is often found to fall down when pursued, and thus becomes an easier prey; for this reason an imaginary virtue has been ascribed to the hinder hoof, which some have supposed to be a specific against all epileptic disorders. This, however, may be considered as a vulgar error; as well as that of its curing itself of this disorder by applying the hinder hoof behind the ear. After all, this animal is but very indifferently and confusedly described by travellers; each mixing his account with something false or trivial; often mistaking some other quadruped for the elk, and confounding its history. Thus some have mistaken it for the rein-deer, which, in every thing but size, it greatly resembles; some have supposed it to be the same with the Tapurette,[1] from which it entirely differs; some have described it as the common red American stag, which scarcely differs from our own; and, lastly, some have confounded it with the Bubalus, which is more properly a gazelle of Africa.[2]

THE REIN-DEER.

Of all animals of the deer kind, the rein-deer is the most extraordinary and the most useful. It is a native of the icy regions of the north; and though many attempts have been made to accustom it to a more southern climate, it shortly feels the influence of the change, and in a few months declines and dies. Nature seems to have fitted it entirely to answer the necessities of that hardy race of mankind that live near the pole. As these would find it impossible to subsist among their barren snowy mountains without its aid, so this animal can only live there, where its assistance is most absolutely necessary. From it alone the natives of Lapland and Greenland supply most of their wants; it answers the purposes of a horse to convey them and their scanty furniture from one mountain to another; it answers the purposes of a cow in giving milk; and it answers the purposes of a sheep, in furnishing them with a warm though a homely kind of clothing. From this quadruped alone, therefore, they receive as many advantages as we derive from three of our most useful creatures; so that Providence does not leave these poor outcasts entirely destitute, but gives them a faithful domestic, more patient and serviceable than any other in nature.

The rein-deer resembles the American elk in the fashion of its horns. It is not easy in words to describe these minute differences, nor will the reader, perhaps, have a distinct idea of the similitude, when told that both have brow antlers, very large, and hanging over their eyes, palmated towards the top, and bending forward like a bow. But here the similitude between these two animals ends,

---

ly when the mosquitoes are troublesome, and to wade into the water and remain there for some hours. The hunters, in order to pursue them thus, procure a canoe as light as possible, but at the same time sufficiently large to carry two men: a thin plank of wood, about a foot wide, and three feet and a half long. This is fixed in the prow of the canoe, like a mast, and in its front is a little shelf, upon which a common lantern, deprived of its door, with a lighted candle is placed. Having thus arranged matters, the hunters embark, and paddle as noiselessly and cautiously as possible along shore. As soon as the canoe is within sight of the deer, they commence gazing at the light; and it seems to fascinate them so completely, that they pay no attention to any other object. But this fascination regards only their sense of sight; their hearing remains as acute as ever, and the most trivial noise will suffice to scare them. In cocking their pieces, therefore, the hunters are very cautious, avoiding all noise, and keeping the canoe so steered as to have the light shining straight to the eyes of the deer. It is not uncommon to be able to approach within twenty, or even ten paces. So easy is this kind of shooting, that an old Frenchman of the *Prairie des Chiens* is said to have killed as many as seven deer in one night.—*American Sporting Magazine.*

[1] Condamine.

[2] Dapper, description de l'Afrique, p. 17.

for as the elk is much larger than the stag, so the rein-deer is much smaller. It is lower, and stronger built than the stag; its legs are shorter and thicker, and its hoofs much broader than in that animal; its hair is much thicker and warmer; its horns much larger in proportion, and branching forward over its eyes; its ears are much larger; its pace is rather a trot than a bounding, and this it can continue for a whole day; its hoofs are cloven and movable, so that it spreads them abroad as it goes, to prevent its sinking in the snow. When it proceeds on a journey, it lays its great horns on its back, while there are two branches which always hang over its forehead, and almost cover its face. One thing seems peculiar to this animal and the elk, which is, that as they move along, their hoofs are heard to crack with a pretty loud noise. This arises from their manner of treading; for as they rest upon their cloven hoof, it spreads on the ground, and the two divisions separate from each other, but when they lift it, the divisions close again, and strike against each other with a crack. The female also of the rein-deer has horns as well as the male; by which the species is distinguished from all other animals of the deer kind whatsoever.

When the rein-deer first shed their coat of hair, they are brown; but in proportion as summer approaches, their hair begins to grow whitish, until, at last, they are nearly gray.[1] They are, however, always black about the eyes. The neck has long hair hanging down, and coarser than upon any other part of the body. The feet, just at the insertion of the hoof, are surrounded with a ring of white. The hair in general stands so thick over the whole body, that if one should attempt to separate it, the skin will no where appear uncovered: whenever it falls also, it is not seen to drop from the root, as in other quadrupeds, but seems broken short near the bottom; so that the lower part of the hair is seen growing, while the upper falls away. The horns of the female are made like those of the male, except that they are smaller and less branching. As in the rest of the deer kind, they sprout from the points; and also in the beginning are furnished with a hairy crust, which supports the blood-vessels of most exquisite sensibility. The rein-deer shed their horns after rutting-time, at the latter end of November; and they are not completely furnished again till towards autumn. The female always retains hers till she brings forth, and then sheds them about the beginning of November. If she be barren, however, which is not unfrequently the case, she does not shed them till winter. The castration of the rein-deer does not prevent the shedding of their horns: those which are the strongest cast them early in the winter; those which are more weakly, not so soon. Thus, from all these circumstances, we see how greatly this animal differs from the common stag. The female of the rein-deer has horns, which the hind is never seen to have; the rein-deer when castrated, renews its horns, which we are assured the stag never does: it differs not less in its habits and manner of living, being tame, submissive, and patient; while the stag is wild, capricious, and unmanageable.

The rein-deer, as was said, is naturally an inhabitant of the countries bordering on the arctic circle.[2] It is not unknown to the natives of Siberia. The north Americans also hunt it under the name of the *caribou*. But in Lapland, this animal is converted to the utmost advantage; and some herdsmen of that country are known to possess above a thousand in a single herd.

Lapland is divided into two districts, the mountainous and the woody. The mountainous part of the country is at best barren and bleak, excessively cold, and uninhabitable during the winter; still, however, it is the most desirable part of this frightful region, and is most thickly peopled during the summer. The natives generally reside on the declivity of the mountains, three or four cottages together, and lead a cheerful and social life. Upon the approach of winter, they are obliged to migrate into the plains below, each bringing down his whole herd, which often amounts to more than a thousand, and leading them where the pasture is in greatest plenty. The woody part of the country is much more desolate and hideous. The whole face of nature there presents a frightful scene of trees without fruit and plains without verdure. As far as the eye can reach, nothing is to be seen, even in the midst of summer, but barren fields, covered only with a moss, almost as white as snow; no grass, no flowery landscapes, only here and there a pine-tree, which may have escaped the frequent conflagrations by which the natives burn down the forests. But what is very extraordinary, as the whole surface of the country is clothed in white, so, on the contrary, the forests seem to the last degree dark and gloomy. While one kind of moss makes the fields look as if they were covered with snow, another kind blackens over all the trees, and even hides their verdure. This moss, however, which deforms the country, serves for its only support, as upon it alone the rein-deer can subsist.[1] The inhabitants, who, during the summer, lived among the mountains, drive down their herds in winter, and people the plains and woods below. Such of the Laplanders as inhabit the woods and the plains all the year round, live remote from each other, and, having been used to solitude, are melancholy, ignorant, and helpless. They are much poorer also than the mountaineers; for, while one of those is found to possess a thousand rein-deer at a time, none of these are ever known to rear the tenth part of that number. The rein-deer makes the riches of this people; and the cold mountainous parts of the country agree best with its constitution. It is for this reason, therefore, that the mountains of Lapland are preferred to the woods; and that many claim an exclusive right to the tops of hills, covered in almost eternal snow. As soon as the summer begins to appear, the Laplander, who had fed his rein-deer upon the lower grounds during the winter, then drives them up to the mountains, and leaves the woody country, and the low pasture, which at that season are truly deplorable. The gnats bred by the sun's heat in the marshy bottoms and the weedy lakes, with which the country abounds more than any other part of the world, are all upon the wing, and fill the whole air like clouds of dust in a dry windy day. The inhabitants, at that time, are obliged to daub their faces with pitch, mixed with milk, to shield their skins from their depredations. All places are then so greatly infested, that the poor natives can scarcely open their mouths without fear of suffocation; the insects enter, from their numbers and minuteness, into the nostrils and the eyes, and do not leave the sufferer a moment at his ease. But they are chiefly enemies to the rein-deer; the horns of that animal being then in their tender state, and possessed of extreme sensibility, a famished cloud of insects instantly settle upon them, and drive the poor animal almost to distraction. In this extremity, there are but two remedies to which the quadruped, as well as its master, are obliged to have recourse. The one is, for both to take shelter near the cottage, where a large fire of tree-moss is prepared, which, filling the whole place with smoke, keeps off the gnats, and thus by one inconvenience expels a greater; the other is, to ascend to the highest summit of the mountains, where the air is too thin, and the weather too cold, for the gnats to come. There the rein-deer are seen to continue the whole day, although without food, rather than to venture down into the lower parts, where they can have no defence against their unceasing persecutors. Besides the gnat, there is also a gadfly, that, during the summer season, is no less formidable to them. This insect is bred under their skins, where the egg has been deposited the preceding summer; and it is no sooner produced as a fly, than it again endeavours to deposit its eggs in some place similar to that from whence it came. Whenever, therefore, it appears flying over a herd of rein-deer, it puts the whole body, how numerous soever, into motion; they know their enemy, and do all they can, by tossing their horns, and running among each other, to terrify or avoid it. All their endeavours, however, are too generally without effect; the gadfly is seen to deposit its eggs, which, burrowing under the skin, wound it in several places, and often bring on an incurable disorder. In the morning, therefore, as soon as the Lapland herdsman drives his deer to pasture, his greatest care is to keep them from scaling the summits of the mountains where there is no food, but where they go merely to be at ease from the gnats and gadflies that are ever annoying them. At this time there is a strong contest between the dogs and the deer; the one endeavouring to climb up against the side of the hill, and to gain those summits that are covered in eternal snows; the other forcing them down, by barking and threatening, and in a manner compelling them into the places where their food is in the greatest quantity. There the men and dogs confine them; guarding them with the utmost precaution the whole day, and driving them home at the proper seasons for milking.

---

[1] For the greatest part of this description of the rein-deer, I am obliged to Mr Hoffberg; upon whose authority, being a native of Sweden, and an experienced naturalist, we may confidently rely.—*Note by Goldsmith.*

[2] An attempt was made about seven years ago to introduce the rein deer upon an extensive scale, in the colder parts of England and Scotland. Many persons will remember Mr Bullock's exhibition of rein-deers and a Lapland family. Out of two hundred deer, which were brought by him from Norway, nearly every one died. Those that were turned out upon the Pentland-hills, near Edinburgh—a situation which was considered peculiarly favourable—all died. A few appeared to do well in a park near Dublin; but we are unable to say if they are still alive. The duke of Athol had previously placed a herd of rein-deer in the mountains of his estate, but the experiment failed in a similar way. This circumstance is not to be attributed to the want of proper food—for the rein-deer moss is found abundantly in Scotland. It grows, too, in many parts of England, particularly on Bagshot-heath. But the same ill success has attended the introduction of the larger species of deer, which belong to the new continent. Several fine species of the Wapiti—an American deer—were turned into Windsor Park a few years ago; none of them lived more than a year. The migratory disposition of these animals is perhaps the reason of their not thriving in an enclosed country.

The female brings forth in the middle of May, and gives milk till about the middle of October. Every morning and evening, during the summer, the herdsman returns to the cottage with his deer to be milked, where the women previously have kindled up a smoky fire, which effectually drives off the gnats, and keeps the rein-deer quiet while milking. The female furnishes about a pint, which, though thinner than that of the cow, is, nevertheless, sweeter and more nourishing. This done, the herdsman drives them back to pasture; as he neither folds nor houses them, neither provides for their subsistence during the winter, nor improves their pasture by cultivation.

---

[1] The rein-deer is said to eat also lemmings or mountain-rats (the *mus lemmus* of Linn.) often pursuing them to such a great distance, as not to be able to find its way home again. Such a propensity in a ruminating animal is without a parallel.

Upon the return of the winter, when the gnats and flies are no longer to be feared, the Laplander descends into the lower grounds; and as there are but few to dispute the possession of that desolate country, he has an extensive range to feed them in. Their chief, and almost their only food at that time, is the white moss already mentioned; which, from its being fed upon by this animal, obtains the name of the *lichen rangiferinus.* This is of two kinds; the woody lichen, which covers almost all the desert parts of the country like snow; the other is black, and covers the branches of the trees in very great quantities. However unpleasing these may be to the spectator, the native esteems them as one of his choicest benefits, and the most indulgent gift of nature. While his fields are clothed with moss, he envies neither the fertility nor the verdure of the more southern landscape; dressed up warmly in his deer skin clothes, with shoes and gloves of the same materials, he drives his herd along the desert, fearless and at ease, ignorant of any higher luxury than what their milk and smoke dried flesh afford him. Hardened to the climate, he sleeps in the midst of ice; or awaking dozes away his time with tobacco; while his faithful dogs supply his place, and keep the herd from wandering. The deer, in the meantime, with instincts adapted to the soil, pursue their food, though covered in the deepest snow. They turn it up with their noses, like swine; and even though its surface be frozen and stiff, yet the hide is so hardened in that part, that they easily overcome the difficulty. It sometimes however, happens, though but rarely, that the winter commences with rain, and a frost ensuing, covers the whole country with a glazed crust of ice. Then, indeed, both the rein-deer and the Laplander are undone; they have no provisions laid up in case of accident, and the only resource is to cut down the large pine trees that are covered with moss, which furnishes but a scanty supply; so that the greatest part of the herd is then seen to perish without a possibility of assistance. It sometimes also happens, than even this supply is wanting; for the Laplander often burns down his woods, in order to improve and fertilize the soil which produces the moss upon which he feeds his cattle.

In this manner, the pastoral life is still continued near the pole; neither the coldness of the winter nor the length of the nights, neither the wildness of the forest, nor the vagrant disposition of the herd, interrupt the even tenor of the Laplander's life. By night and day he is seen attending his favourite cattle, and remains unaffected, in a season which would be speedy death to those bred up in a milder climate. He gives himself no uneasiness to house his herds, or to provide a winter subsistence for them; he is at the trouble neither of manuring his ground, nor bringing in his harvests; he is not the hireling of another's luxury; all his labours are to obviate the necessities of his own situation; and these he undergoes with cheerfulness, as he is sure to enjoy the fruits of his own industry. If, therefore, we compare the Laplander with the peasant of more southern climates, we shall have little reason to pity his situation; the climate in which he lives is rather terrible to us than to him; and as for the rest, he is blessed with liberty, plenty, and ease. The rein-deer alone supplies him with all the wants of life, and some of the conveniences; serving to show how many advantages nature is capable of supplying, when necessity gives the call. Thus the poor little helpless native, who was originally, perhaps, driven by fear or famine into those inhospitable climates, would seem, at first view, to be the most wretched of mankind: but it is far otherwise; he looks round among the few wild animals that his barren country can maintain, and singles out one from among them, and that of a kind which the rest of mankind have not thought worth taking from a state of nature; this he cultivates, propagates, and multiplies; and from this alone derives every comfort that can soften the severity of his situation.[1]

---

[1] From the earliest times the rein-deer appears to have been domesticated by the Laplanders; and that dreary region owes to this animal whatever it possesses of civilization, and whatever comforts tend to render it supportable to the inhabitants.

The Laplanders are divided into two very distinct classes; one who are settled in their habits, living on or near the coast, and supporting themselves by fishing; the other inhabiting the mountains, and wandering through the summer and winter with no shelter but their tents, and no provision but their rein-deer. These valuable animals, however, are subject to a visitation in the summer which compels their owners to repair to the coast, frequently an arduous journey, in order to mitigate their sufferings and preserve their lives. M. De Broke, in his Travels in Lapland, thus describes these migrations:—

"Whale Island, during the summer months, is never without three or four families of mountain Laplanders (Field-finner), with their herds of rein-deer. The causes that induce, nay, even compel these people to undertake their long and annual migrations from the interior parts of Lapland to its coast, though they may appear singular, are sufficiently powerful. It is well known, from the

The rein-deer of this country are of two kinds, the wild and the tame. The wild are larger and stronger, but more mischievous than the others. Their breed, however, is preferred to that of the tame; and the female of the latter is often sent into the woods, from whence she returns home impregnated by one of the wild kind. These are fitter for drawing the sledge, to which the Laplander accustoms them betimes, and yokes them to it by a strap, which goes round the neck, and comes down between their legs. The sledge is extremely light, and shod at the bottom with the skin of a young deer, the hair turned to slide on the frozen snow. The person who sits on this guides the animal with a cord, fastened round the horns, and encourages it to proceed with his voice, and drives it with a goad. Some of the wild breed, though by far the strongest, are yet found refractory, and often turn upon their drivers; who have then no other resource but to cover themselves with their sledge, and let the animal vent its fury upon that. But it is otherwise with those that are tame; no creature can be more active, patient, and willing; when hard pushed, they will trot nine or ten Swedish miles, or between fifty and sixty English miles, at one stretch. But, in such a case, the poor obedient creature fatigues itself to death, and, if not prevented by the Laplander, who kills it immediately, it will die in a day or two after. In general, they can go about thirty miles without halting, and this without any great or dangerous efforts. This, which is the only manner of travelling in that country, can be performed only in winter, when the snow is glazed over with ice; and although it be a very speedy method of conveyance, yet it is inconvenient, dangerous, and troublesome.

In order to make these animals more obedient, and more generally serviceable, they castrate them; which operation the Laplanders perform with their teeth; these become sooner fat when taken from labour; and they are found to be stronger in drawing the sledge. There is usually one male left entire for every six females; these are in rut from the feast of St Matthew to about Michaelmas. At this time their horns are thoroughly burnished, and their battles among each other are fierce and obstinate. The females do not begin to breed till they are two years old; and then they continue regularly breeding every year till they are superannuated. They go with young above eight months, and generally bring forth two at a time. The fondness of the dam for her young is very remarkable; it often hap-

---

account of those travellers who have visited Lapland during the summer months, that the interior parts of it, particularly its boundless forests, are so infested by various species of gnats and other insects, that no animal can escape their incessant persecutions. Large fires are kindled, in the smoke of which the cattle hold their heads to escape the attack of their enemies; and even the natives themselves are compelled to smear their faces with tar, as the only certain protection against their stings. No creature, however, suffers more than the rein-deer from the larger species (œstrus tarandi), as it not only torments it incessantly by its sting, but even deposits its egg in the wound it makes in its hide. The poor animal is thus tormented to such a degree, that the Laplander, if he were to remain in the forests during the months of June, July, and August, would run the risk of losing the greater part of his herd, either by actual sickness, or from the deer fleeing of their own accord to mountainous situations to escape the gadfly. From these causes the Laplander is driven from the forests to the mountains that overhang the Norway and Lapland coasts, the elevated situations of which, and the cool breezes from the ocean, are unfavourable to the existence of these troublesome insects, which, though found on the coast, are in far less considerable numbers there, and do not quit the valleys; so that the deer, by ascending the highlands, can avoid them."

Early in September the herds and their owners leave the coast, in order to reach their winter quarters before the fall of the snows. With the approach of winter, the coat of the rein-deer begins to thicken, and like that of most other polar quadrupeds, to assume a lighter colour. It is, however, when the winter is fairly set in that the peculiar value of the rein-deer is felt by the Laplanders. Without him, communication would be almost utterly suspended. Harnessed to a sledge, the rein-deer will draw about 300 lbs.; but the Laplanders generally limit the burthen to 240 lbs. The trot of the rein-deer is about ten miles an hour; and the animal's power of endurance is such, that journeys of one hundred and fifty miles in nineteen hours are not uncommon. There is a portrait of a rein-deer in the palace of Drotningholm (Sweden), which is represented, upon an occasion of emergency, to have drawn an officer with important despatches the incredible distance of eight hundred English miles in forty-eight hours. This event is stated to have happened in 1699, and the tradition adds, that the deer dropped down lifeless upon his arrival.

During the winter, the food of the rein-deer is the lichen or moss, which they display wonderful quickness of smell in discovering beneath the snow. In the summer they pasture upon all green herbage, and browse upon the shrubs which they find in their march. They also, as has been mentioned in a previous note, eat with avidity the lemming or mountain rat, thus affording the only well ascertained instance of a ruminating animal being in the slightest degree carnivorous.

Of course, in a country where their services are so indispensable, rein-deer constitute the principal wealth of the inhabitants. M. De Broke says,—"The number of deer belonging to a herd is from three hundred to five hundred; with these a Laplander can do well, and live in tolerable comfort. He can make in summer a sufficient quantity of cheese for the year's consumption; and, during the winter season, can afford to kill deer enough to supply him and his family pretty constantly with venison. With two hundred deer, a man, if his family be but small, can manage to get on. If he have but one hundred, his subsistence is very precarious, and he cannot rely entirely upon them for support. Should he have but fifty, he is no longer independent, or able to keep a separate establishment, but generally joins his small herd with that of some richer Laplander, being then considered more in the light of a menial, undertaking the laborious office of attending upon and watching the herd, bringing them home to be milked, and other similar offices, in return for the subsistence afforded him."

pens that when they are separated from her, she will return from pasture, keep calling round the cottage for them, and will not desist until, dead or alive, they are brought and laid at her feet. They are at first of a light brown; but they become darker with age; and at last the old ones are of a brown, almost approaching to blackness. The young follow the dam for two or three years; but they do not acquire their full growth until four. They are then broke in, and managed for drawing the sledge; and they continue serviceable for four or five years longer. They never live above fifteen or sixteen years; and when they arrive at the proper age, the Laplander generally kills them for the sake of their skins and their flesh. This he performs by striking them on the back of the neck with his knife into the spinal marrow; upon which they instantly fall, and he then cuts the arteries that lead to the heart, and lets the blood discharge itself into the cavity of the breast.

There is scarcely any part of this animal that is not converted to its peculiar uses. As soon as it begins to grow old, and some time before the rut, it is killed, and the flesh dried in the air. It is also sometimes hardened with smoke, and laid up for travelling provision, when the natives migrate from one part of the country to another. During the winter, the rein-deer are slaughtered as sheep with us; and every four persons in the family are allowed one rein-deer for their week's subsistence. In spring they spare the herd as much as they can, and live upon fresh fish. In summer, the milk and curd of the rein-deer makes their chief provision; and, in autumn, they live wholly upon fowls, which they kill with a cross bow, or catch in springs. Nor is this so scanty an allowance; since, at that time, the sea-fowls come in such abundance that their ponds and springs are covered over. These are not so shy as with us, but yield themselves an easy prey. They are chiefly allured to those places by the swarms of gnats which infest the country during summer, and now repay the former inconvenience, by inviting such numbers of birds as supply the natives with food a fourth part of the year in great abundance.

The milk, when newly taken, is warmed in a cauldron, and thickened with rennet; and then the curd is pressed into cheeses, which are little and well tasted. These are never found to breed mites as the cheese of other countries; probably because the mite-fly is not to be found in Lapland. The whey which remains is warmed up again, and becomes of a consistence as if thickened with the white of eggs. Upon this the Laplanders feed during the summer; it is pleasant and well tasted but not very nourishing. As to butter, they very seldom make any, because the milk affords but a very small quantity, and this, both in taste and consistence, is more nearly resembling to suet. They never keep their milk till it turns sour; and do not dress it into the variety of dishes which the more southern countries are known to do. The only delicacy they make from it is with wood-sorrel, which being boiled up with it, and coagulating, the whole is put into casks, or deer skins, and kept under ground to be eaten in winter.

The skin is even a more valuable part of this animal than either of the former. From that part of it which covered the head and feet, they make their strong snow-shoes, with the hair on the outside. Of the other parts they compose their garments, which are extremely warm, and which cover them all over. The hair of these also is on the outside; and they sometimes line them also with the fur of the glutton, or some other warm-furred animal of that climate. These skins also serve them for beds. They spread them on each side of the fire, upon some leaves of the dwarf birch-tree, and in this manner lie both soft and warm. Many garments made of the skin of the rein-deer are sold every year to the inhabitants of the more southern parts of Europe; and they are found so serviceable in keeping out the cold, that even people of the first rank are known to wear them.

In short, no part of this animal is thrown away as useless. The blood is preserved in small casks, to make sauce with the marrow in spring. The horns are sold to be converted into glue. The sinews are dried, and divided so as to make the strongest kind of sewing thread, not unlike catgut. The tongues, which are considered as a great delicacy, are dried, and sold into the more southern provinces. The intestines themselves are washed like our tripe, and in high esteem among the natives. Thus the Laplander finds all his necessities amply supplied from this single animal; and he who has a large herd of these animals has no idea of higher luxury.

But although the rein-deer be a very hardy and vigorous animal, it is not without its diseases. I have already mentioned the pain it feels from the gnat, and the apprehensions it is under from the gadfly. Its hide is often found pierced in a hundred places, like a sieve, from this insect, and not a few die in their third year from this very cause. Their teats also are subject to cracking, so that blood comes instead of milk. They sometimes take a loathing for their food; and, instead of eating, stand still and chew the cud. They are also troubled with a vertigo, like the elk, and turn round often till they die. The Laplander judges of their state by the manner of their turning. If they turn to the right, he judges their disorder but slight; if they turn to the left, he deems it incurable. The rein-deer are also subject to ulcers near the hoof, which unqualifies them for travelling, or keeping with the herd. But the most fatal disorder of all is, that which the natives call the *suddataka*, which attacks this animal at all seasons of the year. The instant it is seized with this disease, it begins to breathe with greater difficulty; its eyes begin to stare, and its nostrils to expand. It acquires also an unusual degree of ferocity, and attacks all it meets indiscriminately. Still, however, it continues to feed as if in health, but is not seen to chew the cud, and it lies down more frequently than before. In this manner it continues, every day consuming and growing more lean, till at last it dies from mere inanition; and not one of those that are attacked with this disorder are ever found to recover. Notwithstanding, it is but very lately known in that part of the world; although, during the last ten or fifteen years, it has spoiled whole provinces of this necessary creature. It is contagious; and the moment the Laplander perceives any of his herd infected, he hastens to kill them immediately, before it spreads any further. When examined internally, there is a frothy substance found in the brain, and round the lungs; the intestines are lax and flabby, and the spleen is diminished almost to nothing. The Laplander's only cure in all these disorders, is, to anoint the animal's back with tar; if this does not succeed, he considers the disease as beyond the power of art; and, with his natural phlegm, submits to the severities of fortune.

Besides the natural maladies of this animal, there are some external enemies which it has to fear. The bears now and then make depredations upon the herd, but of all their persecutors, the creature called the *glutton* is the most dangerous and the most successful. The war between these is carried on not less in Lapland than in North America, where the rein-deer is called the *carribou* and the *glutton* the *carajou*. This animal, which is not above the size of a badger, waits whole weeks together for its prey, hid in the branches of some spreading tree; and when the wild rein-deer passes underneath, it instantly drops down upon it, fixing its teeth and claws into the neck, just behind the horns. It is in vain that the wounded animal then flies for protection, that it rustles among the branches of the forest, the glutton still holds its former position; and, although it often loses a part of its skin and flesh, which are rubbed off against the trees, yet it still keeps fast until its prey drops with fatigue and loss of blood. The deer has but one only method of escape, which is by jumping into the water; that element its enemy cannot endure; for, as we are told, it quits its hold immediately, and then thinks only of providing for its own proper security.

The following are interesting varieties of the deer and antelope tribes, which will be found figured in the coloured plates, XXXVI. and XXXVII.:—

Salt's Antelope *(Neotragus saltiana)*. This beautiful animal was first introduced by specimens brought from Abyssinia by the British Consul, Mr. Salt. Height thirteen inches, and limbs of great delicacy; forehead and limbs a reddish brown, outsides of fore-legs with whitish spots, neck and sides grey, lower parts almost pure white. The male only has horns of about three inches in length. (Pl. XXXVI. fig. 6.)

The Takhaitze *(Antilope barbata)*. This animal is found on the edge of the Karroo Plains, in the latitude of Latakoo. It is exceedingly shy, and when wounded, dangerous to approach. The usual height is about five feet, and the general shape similar to that of the Nyl-gau. Both male and female have horns, pointing backwards in a regular curve. They are found mostly in pairs, but sometimes in small herds of five or six; they are taken in deep pits, and their flesh is esteemed a delicacy. (Pl. XXXVI. fig. 7.)

The Pallah *(Antilope melampus)*. Found in the interior of Caffraria, and Booshowana country, in very small herds. It is timid and fleet, but easily tamed; height about three feet, and length five feet. Horns of a lyrate form. (Pl. XXXVI. fig. 3.)

The Addax *(Onyx addax)*. This animal is found throughout the Nubian Desert, which it traverses with great fleetness. The spiral twisting of the horns forms one of its characteristics, and another is the wide-spreading hoof, which prevents the animal from sinking into the sands. Its height is fully three feet; its colour is subject to change, being at some seasons a dullish grey. (Pl. XXXVI. fig. 1.)

The Koodoo *(Strepsiceros koodoo)*. Inhabits the woody parts of Caffraria, but is getting scarce. It is soon brought to bay, when it defends itself with its long horns, which rise up perpendicularly in large spiral whorls. The male is nearly four feet high, and about eight feet long. This animal combines many of the characteristics of the sheep, ox, and antelope. (Pl. XXXVI. fig. 2.)

The Guazupuco Deer *(Mazama paludosa)*. This deer inhabits the lower districts of Paraguay. It is nearly as large as the European stag. (Pl. XXXVII. fig. 7.)

The Guazuti Deer *(Mazama campestris)*. A beautiful South American deer, now rarely met with, standing only about two feet and a half high, measuring from the shoulder. The horns are slender, and about a foot in length. It inhabits the open plains, and is so swift that a horse cannot overtake it. The flesh is delicate, and is said to be an antidote to the poison of serpents when applied to the bite. (Pl. XXXVII. fig. 10.)

The Great Rusa *(Rusa hippelaphus)*. Mentioned by Cuvier as found in Bengal, but the principal abode of this animal is probably the islands of the Indian Archipelago. It is remarkable for its mane, which gives it a resemblance to the horse, whence its name of *hippelaphus*. Height about three feet. (Pl. XXXVII. fig. 11.)

A

HISTORY OF ANIMALS.

BOOK III.

QUADRUPEDS OF THE HOG KIND.

CHAP. I.

INTRODUCTION.

ANIMALS of the hog kind seem to unite in themselves all those distinctions by which others are separated. They resemble those of the horse kind in the number of their teeth, which, in all, amount to forty-four, in the length of their head, and in having but a single stomach. They resemble the cow kind in their cloven hoofs and the position of their intestines; and they resemble those of the claw-footed kind in their appetite for flesh, in their not chewing the cud, and in their numerous progeny. Thus this species serves to fill up that chasm which is found between the carnivorous kinds and those that live upon grass, being possessed of the ravenous appetite of the one, and the inoffensive nature of the other. We may consider them, therefore, as of a middle nature, which we can refer neither to the rapacious nor the peaceful kinds, and yet partaking somewhat of the nature of both. Like the rapacious kinds, they are found to have short intestines; their hoofs also, though cloven to the sight, will, upon anatomical inspection, appear to be supplied with bones like beasts of prey; and the number of their teats also increase the similitude: on the other hand, in a natural state they live upon vegetables, and seldom seek after animal food, except when urged by necessity. They offend no other animal of the forest, at the same time that they are furnished with arms to terrify the bravest.

THE WILD BOAR,[1]

Which is the original of all the varieties we find in this creature, is by no means so stupid nor so filthy an animal, as that we have reduced to tameness; he is much smaller than the tame hog, and does not vary in his colour as those of the domestic kind do, but is always found of an iron grey inclining to black; his snout is much longer than that of the tame hog, and the ears are shorter, rounder, and black; of which colour are also the feet and the tail. He roots the ground in a different manner from the common hog; for as this turns up the earth in little spots here and there, so the wild boar ploughs it up like a furrow, and does irreparable damage in the cultivated lands of the farmer. The tusks also of this animal are larger than in the tame breed, some of them being seen almost a foot long.[3] These, as is well known, grow from both the under and upper jaw, bent upwards circularly, and are exceedingly sharp at the points. They differ from the tusks of the elephant in this, that they never fall; and it is remarkable of all the hog kind that they never shed their teeth as other animals are seen to do. The tusks of the lower jaw are always the most to be dreaded, and are found to give very terrible wounds.

The wild boar can properly be called neither a solitary nor a gregarious animal. The three first years the whole litter follows the sow, and the family lives in a herd together; they are then called beasts of company, and unite their common forces against the invasions of the wolf, or the more formidable beasts of prey. Upon this their principal safety, while young, depends; for, when attacked, they give each other mutual assistance, calling to each other with a very loud and fierce note; the strongest face the danger; they form a ring, and the weakest fall into the centre. In this position few ravenous beasts dare venture to attack them, but pursue the chase where there is less resistance and danger. However, when the wild boar is come to a state of maturity, and when conscious of his own superior strength, he then walks the forest alone and fearless. At that time he dreads no single creature, nor does he turn out of his way even for man himself. He does not seek danger, and he does not much seem to avoid it.

---

[1] The animals of this tribe have four front teeth in the upper jaw, which converge at their points; and generally six in the lower jaw, which project. The canine teeth, or tusks, are two in each jaw; those in the upper jaw short, those in the lower jaw extending beyond the mouth. The snout is prominent, movable, and has the appearance of having been abruptly cut off; the hoofs are cloven.

[2] The Æthiopian or Masked Boar.—This species is distinguished by a fleshy protuberance on the fore part of the head, enveloping the upper part of it like a mask. It is a native of the Cape, nearly the size of the European boar, and has all its proportions. The only distinction is the fleshy prominences. The head of this species is, moreover, distinguished by a large arch formed

[3] Buffon, vol. ix. p. 147.

This animal is therefore seldom attacked, but at a disadvantage, either by numbers, or when found sleeping by moonlight. The hunting the wild boar is one of the principal amusements of the nobility in those countries where it is to be found. The dogs provided for this sport are of the slow heavy kind; those used for hunting the stag, or the roebuck, would be very improper, as they would too soon come up with their prey, and, instead of a chase, would only furnish out an engagement. A small mastiff is therefore chosen; nor are the hunters much mindful of the goodness of their nose, as the wild boar leaves so strong a scent that it is impossible for them to mistake its course. They never hunt any but the largest and the oldest, which are known by their tracks. When the boar is *reared*, as is the expression for driving him from his covert, he goes slowly and uniformly forward, not much afraid, nor very far before his pursuers. At the end of every half mile, or thereabouts, he turns round, stops till the hounds come up, and offers to attack them. These, on the other hand, knowing their danger, keep off and bay him at a distance. After they have for a while gazed upon each other with mutual animosity, the boar again slowly goes on his course, and the dogs renew the pursuit. In this manner the charge is sustained, and the chase continues till the boar is quite tired, and refuses to go any farther. The dogs then attempt to close in upon him from behind; those which are young, fierce, and unaccustomed to the chase, are generally the foremost, and often lose their lives by their ardour; those which are older and better trained are content to wait until the hunters come up, who strike at him with their spears, and after several blows, despatch or disable him. The instant the animal is killed, they cut off the testicles, which would otherwise give a taint to the flesh; and the huntsmen celebrate the victory with their horns.[1]

---

by the cheek-bones, and by the long surface to which the muscles of the trunk are attached. The habits of this animal are little known; but it appears to be very wild, dangerous, and untractable. See a representation of it in Plate XIII. fig. 35.

The Æthiopian or Masked Boar differs, in some respects, from *Ælian's Wart Hog*, found in the north of Africa, though both are characterized by warts or excrescences on the cheeks, formed out of a thickened skinny texture. The *Papuan Hog* abounds in New Guinea. It wants the tusks of the wild boar, and has only eight paps, by which it approaches the Peccaries, the common sow having generally twelve. The *Babyrousa*, another species of hog, is noticed in a succeeding page. In the South Sea Islands, there is a small, short-legged black variety of Pig, which some authors consider as derived from another stock than the wild boar.

[1] In every country where the wild boar was found, the hunting of the animal was a favourite sport. In ancient times, it was practised equally by the civilised Romans, and by our own barbarous forefathers in Germany, and in this island. In the 'Description of London,' by Fitzstephen, written in the reign of Henry II., in the latter part of the twelfth century, it is stated that the forest by which London was then surrounded was frequented by boars as well as various other wild animals. In Scotland a tract of country now forming one of the extremities of the county of Fife was anciently called Muckross, which in Celtic signifies the Boar-promontory. The tradition is, that it was famous as a haunt of boars. A district forming a portion of it is in old writings designated by the name of the Boar Hills, which has now been corrupted into Byre Hills. It lies in the vicinity of St Andrews, in the cathedral church of which city it is said that there were to be seen before the Reformation, attached by chain to the high altar, two boar's tusks of the extraordinary length of sixteen inches each, the memorials of an enormous brute which had been slaughtered by the inhabitants after having long infested the neighbourhood.

Boar-hunting was a sport by no means unattended with danger to the hunter himself, as well as to his dogs. As practised during the middle ages, the animal, when brought to a stand, was attacked, sometimes on horseback and sometimes on foot; and either by swords which were struck into his flesh, or by strong spears which were protruded against him till he either rushed upon the point, or exposed himself to a thrust from the person by whom the weapon was held. The parts into which it was attempted to plunge the spear, with the view of inflicting the most deadly wounds, were the forehead, between the eyes, and the breast, immediately under the shoulder-blade. It sometimes happened, however, that the boar would, by a sudden movement, contrive to seize the haft of the protruded spear between his powerful jaws, in which case his assailant was exposed to the most imminent danger of destruction. One crunch was sufficient to grind the wood to fragments; and the next instant, unless some one was by to renew the attack, the enraged beast had his unarmed enemy upon the ground under his hoofs, and was ripping him up with his tusks. When horses were employed, they were frequently wounded in this way.

Boar-hunting is still a favourite amusement in India; but there the sport appears to be always followed on horseback, and the animal is attacked by long spears or javelins, which are not usually thrust into his flesh, the hunter retaining a hold of the weapon, but are lanced at him from a distance of twenty or thirty yards, as he

THE HOG.

(See plate XIII. fig. 34.)

In a natural state, is found to feed chiefly upon roots and vegetables; it seldom ever attacks any other animal, being content with such provisions as it procures without danger. Whatever animal happens to die in the forest, or is so wounded that it can make no resistance, becomes a prey to the hog, who seldom refuses animal food how putrid soever, although it is never at the pains of taking or procuring it alive. For this reason, it seems a glutton rather by accident than choice, content with vegetable food, and only devouring flesh when pressed by necessity, and when it happens to offer. Indeed, if we behold the hog in its domestic state, it is the most sordid and brutal animal in nature.[1] The awkwardness of its form seems to influence its appetites; and all its sensations are as gross as its shapes are unsightly. It seems possessed only of an insatiable desire of eating; and it seems to make choice only of what other animals find the

---

flies before his mounted pursuers. The Indian wild hog does not seem to be quite so ferocious an animal as either the African or the European species. Ample and interesting details and anecdotes on hog-hunting in India may be found in the works upon Indian field sports by Daniel, Williamson, and Johnson. Among other anecdotes, Mr Johnson relates the following:—"I was one of a party of eight gentlemen on a sporting excursion at Hye, near the city of Patna, on the banks of the Soane river. Returning one morning from shooting, we met with a very large boar in a rhur,* which we did not fire at or molest, as several of the gentlemen were very fond of hunting them, and we had no spears with us. The next morning we all sallied forth in search of him, and, just as we arrived at the spot where we saw him the day before, we discovered him, at some distance, trotting off towards a grass jungle, on the banks of the river: we pressed on our horses as fast as possible, and were nearly up with him, when he disappeared all at once; our horses were then nearly at their full speed, and four of them could not be pulled up in time to prevent their going into a deep branch of the river, the banks of which were at least fourteen or fifteen feet high;—luckily for us there was no water in it, or anything but fine sand, and no person was hurt. One of the horses, which was very vicious, got loose, attacked the others, and obliged all the gentlemen to quit them, and walk to their tents, where one of the horses had arrived before them, and the rest were soon caught. A few days after this we went again early in the morning in pursuit of the same hog, and found him farther off from the grass jungle, in a rhur-field, from which, with much difficulty, we drove him into a plain, where he stood at bay, challenging the whole party, boldly charging every horse that came within fifty yards of him, grunting loudly as he advanced. I was then a novice in the sport, but I have never since seen any hog charge so fiercely. The horse I rode would not go near him, and when I was at a considerable distance off, he charged another horse with such ferocity that mine reared and plunged in such a violent manner as to throw me off: two or three others were dismounted nearly at the same time, and although there were many horses present that had been long accustomed to the sport, not one of them would stand his charge; he fairly drove the whole party off the field, and gently trotted on to the grass jungle, (foaming and grinding his tusks,) through which it was impossible to follow or drive him. The largest boar I have ever seen killed was extremely old and thin; he measured, in height to the top of the shoulder, forty-three inches, and his tusks were ten inches long. He was fierce, but showed little sport, owing to his taking shelter in a thick rhur-field, from which we could not drive him. Two very large greyhounds were slipped to him; one of them he instantly killed, and the other he severely wounded. A random spear, thrown by a gentleman who did not see him distinctly at the time, struck him in the head, and he fell dead without receiving any other wound."

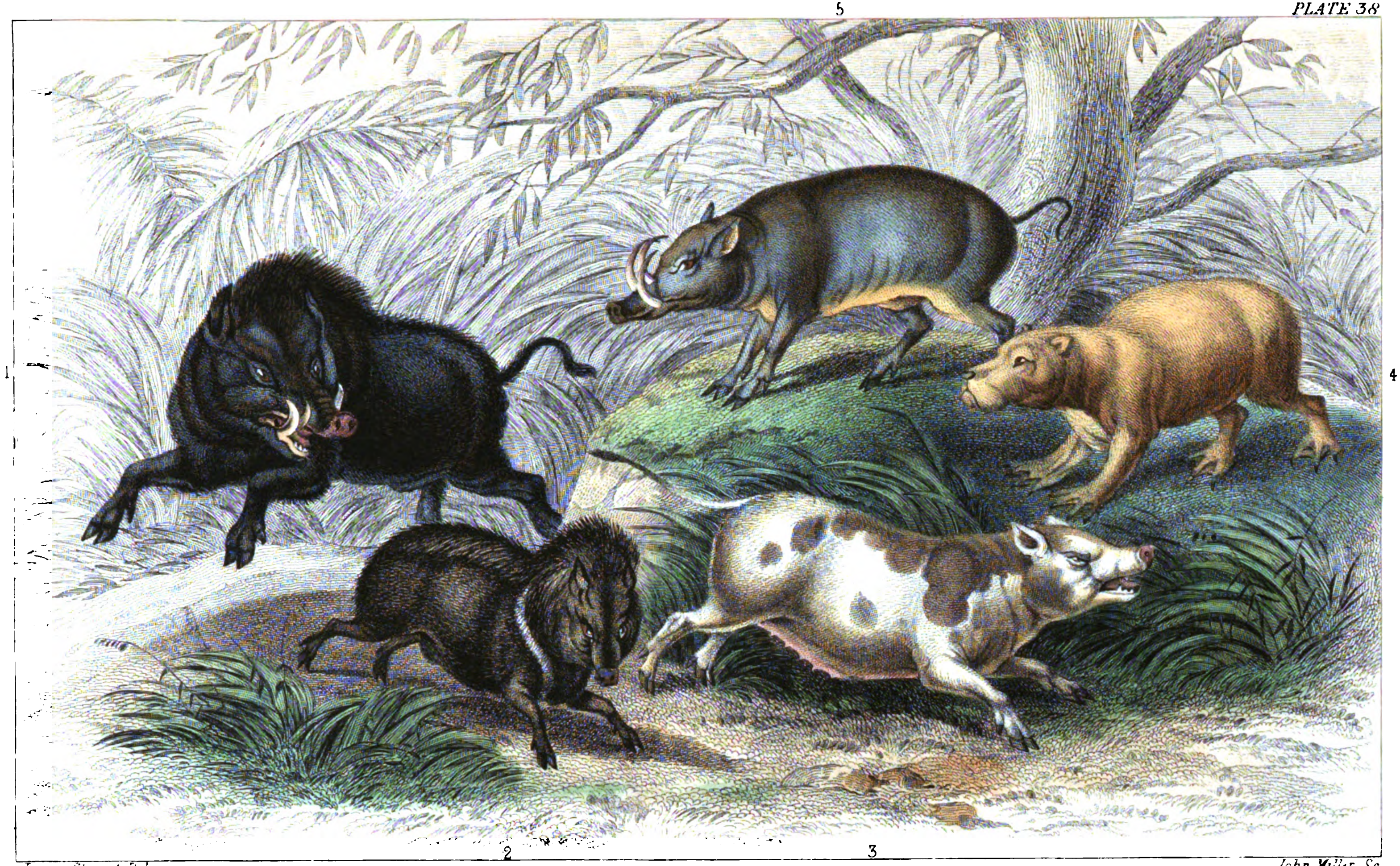
* "Rhur is a species of lupine, or pulse, which grows to the height of from four to six or seven feet; the seeds are eaten by the natives of India, and are also given to the cattle."

In England there has been no boar-hunting for some ages. In France, however, where there are large tracts of forest which supply fuel to the towns, boars are not uncommon, although their ferocity is much diminished. At Chantilly, within forty miles of Paris, the late Prince of Condé (who died in 1830) kept a regular pack of hounds for hunting the boar. They were large and strong dogs, much resembling the English fox-hound, though more muscular and bony. The huntsman, in the summer of 1830, mentioned to some English gentlemen who visited this hunting palace, that he had seen at one time, a few days previous, as many as fourteen wild pigs in the forest of Chantilly. Boar-hunting is still practised in some parts of Germany, but in a fashion which at once deprives the sport of its only redeeming quality—its adventurous character, and makes it more cruel and sanguinary than ever. The animals who are to be destroyed are first enclosed in a sort of pen, from which they can only escape by one opening, and when they attempt to rush out, are slaughtered there by the hunters, who sit on horseback, armed with spears and swords, with which they have only to strike them till they expire.

In some countries, even the domesticated hog retains a great deal of the fierceness which characterizes the wild breed. Mr Lloyd, in his 'Field Sports of the North of Europe,' relates the following adventure, which befell him near Carlstad in Sweden:—"Towards evening, and when seven or eight miles from home, we came to a small hamlet, situated on the recesses of the forest: here an old sow and her progeny made a determined dash at a brace of very valuable pointers I at that time had along with me, and who naturally took shelter behind us. My man had a light spear in his hand, similar to those used by our lancers; this I took possession of; and directing him to throw the dogs over a fence, in the angle of which we were cooped up, I placed myself between the dogs and their pursuers. The sow, nevertheless, pressed forward; and it was only by giving her a severe blow across the snout, with the butt-end of the spear that I stopped her further career. Nothing daunted, however, by this reception, she directed her next attack against myself; when in self-defence, I was obliged to give her a homethrust with the point of the spear. These attacks she repeated three several times, and as often got the spear up to the hilt in either her head or neck. She then slowly retreated, bleeding at all pores. So savage and ferocious a beast I never saw in my life. In the fray I broke my spear, which was as well, for it was by no means strong enough to answer the purpose for which it was intended . . . This was not a solitary instance of the ferocity of pigs. It was the same throughout Sweden; for, whenever they caught sight of my dogs, they generally charged; and, if they came up with them, would tumble them over and over again with their snouts."

[1] Buffon, vol. ix. p. 14.

PLATE 38



James Stewart Del — John Miller Sc

1. WILD BOAR. 2. COLLARED PECCARY. 3. CHINESE SOW. 4. CAPIBARA. 5. BABYROUSSA.

Blackie & Son Glasgow Edinburgh & London

most offensive. But we ought to consider that the hog with us is in an unnatural state, and that it is in a manner compelled to feed in this filthy manner, from wanting that proper nourishment which it finds in the forest. When in a state of wildness it is of all other quadrupeds the most delicate in the choice of what vegetables it shall feed on, and rejects a greater number than any of the rest. The cow, for instance, as we are assured by Linnæus, eats two hundred and seventy-six plants, and rejects two hundred and eighteen; the goat eats four hundred and forty-nine, and rejects a hundred and twenty-six; the sheep eats three hundred and eighty-seven, and rejects a hundred and forty-one; the horse eats two hundred and sixty-two, and rejects two hundred and twelve; but the hog, more nice in its provision than any of the former, eats but seventy-two plants, and rejects a hundred and seventy-one. The indelicacy of this animal is, therefore, rather in our apprehensions than in its nature, since we find it makes a very distinguishing choice in the quality of its food; and if it does not reject animal putrefaction, it may be because it is abridged in that food which is most wholesome and agreeable to it in a state of nature. This is certain, that its palate is not insensible to the difference of eatables: for where it finds variety, it will reject the worst with as distinguishing a taste as any other quadruped whatsoever.[1] In the orchards of peach-trees in North America, where the hog has plenty of delicious food, it is observed, that it will reject the fruit that has lain but a few hours on the ground, and continue on the watch whole hours together for a fresh wind-fall.

However, the hog is naturally formed in a more imperfect manner than the other animals that we have rendered domestic around us, less active in its motions, less furnished with instinct in knowing what to pursue or what to avoid. Without attachment, and incapable of instruction, it continues, while it lives, a useless, or rather a rapacious dependent. The coarseness of its hair, and the thickness of its hide, together with the thick coat of fat that lies immediately under the skin, render it insensible to blows, or rough usage. Mice have been known to burrow in the back of these animals while fattening in the sty,[2] without their seeming to perceive it. Their other senses seem to be in tolerable perfection; they scent the hounds at a distance, and as we have seen, they are not insensible in the choice of their provisions.

The hog is by nature, stupid, inactive, and drowsy;[3] if undisturbed it would sleep half its time; but it is frequently awaked by the calls of appetite, which when it has satisfied, it goes to rest again. Its whole life is thus a round of sleep and gluttony; and, if supplied with sufficient food it soon grows unfit even for its own existence; its flesh becomes a greater load than its legs are able to support, and it continues to feed lying down, or kneeling, a helpless instance of indulged sensuality. The only times it seems to have passions of a more active nature, are when it is incited by venery, or when the wind blows with any vehemence. Upon this occasion, it is so agitated as to run violently towards its sty, screaming horribly at the same time; which seems to argue that it is naturally fond of a warm climate. It appears also to foresee the approach of bad weather, bringing straw to its sty in its mouth, preparing a bed, and hiding itself from the impending storm. Nor is it less agitated when it hears any of its kind in distress; when a hog is caught in a gate, as is often the case, or when it suffers any of the usual domestic operations of ringing or spaying, all the rest are then seen to gather round it, to lend their fruitless assistance, and to sympathize with its sufferings. They have often also been known to gather round a dog that had teased them, and kill him upon the spot.

Most of the diseases of this animal arise from intemperance; measles, imposthumes, and scrofulous swellings, are reckoned among the number. It is thought by some that they wallow in the mire to destroy a sort of louse, or insect, that is often found to infest them, however, they are generally known to live, when so permitted, to eighteen or twenty years: and the females produce till the age of fifteen. As they produce from ten to twenty young at a litter, and that twice a-year, we may easily compute how numerous they would shortly become, if not diminished by human industry. In the wild state they are less prolific; and the sow of the woods brings forth but once a year, probably because exhausted by rearing up her former numerous progeny.[1]

---

[1] British Zoology, vol. i. p. 42.

[2] Buffon.

[3] The various learned pigs which have been at different times exhibited in Britain, afford sufficient proof that these animals are not destitute of natural sagacity or incapable of instruction. "A game-keeper of Sir H Mildmay," says the Rev. Mr Daniel, "actually broke a black sow to find game, and to back and stand. *Slut*, which was the name he gave her, was rendered as staunch as any pointer. After Sir Henry's death, this *pig-pointer* was sold by auction for a very considerable sum of money; but possibly the secret of breaking swine to the field expired with the inventor." Colonel Thornton also possessed a sow which was taught regularly to hunt, quarter the ground, and to back the other pointers. Her scent was very sure. She was trained by good treatment, and a reward of bread carried in the pocket of the keeper. In the island of Minorca, hogs are converted into beasts of draught; a cow, a sow, and two young horses, have been there seen yoked together, and of the four the cow drew the least.—The ass and the hog are here also common helpmates, and are frequently yoked together to plough the land. In some parts of Italy, hogs are used in hunting for truffles, which grow some inches deep in the ground. A cord being tied round the hind leg of one of the animals, the beast is driven into the pastures, and wherever it stops and begins to root with its nose, truffles are always to be found.

It would be superfluous to dwell longer upon the nature and qualities of an animal too well known to need a description; there are few, even in cities, who are unacquainted with its uses, its appetites, and way of living. The arts of fattening, rearing, guarding, and managing hogs, fall more under the cognizance of the farmer than the naturalist; they make a branch of domestic economy, which properly treated, may be extended to a great length; but the history of nature ought always to end where that of art begins. It will be sufficient, therefore, to observe that the wild boar was formerly a native of our country, as appears from the laws of Hoel-Dda,[2] the famous Welch legislator, who permitted his grand huntsman to chase that animal from the middle of November to the beginning of December. William the Conqueror also punished such as were convicted of killing the wild boar in his forests with the loss of their eyes. At present the whole wild breed is extinct; but no country makes greater use of the tame kinds, as their flesh, which bears salt better than that of any other animal, makes a principal part of the provisions of the British navy.

As this animal is a native of almost every country, there are some varieties found in the species. That which we call the East India [or Chinese] breed, is lower, less furnished with hair, is usually black, and has the belly almost touching the ground; it is now common in England; it fattens more easily than the ordinary kinds, and makes better bacon.

There is a remarkable variety of this animal about Upsal,[3] which is single-hoofed, like the horse; but in no other respect differing from the common kinds. The authority of Aristotle, who first made mention of this kind, has been often called in question; some have asserted, that such a quadruped never existed, because it happened not to fall within the sphere of their own confined observation; however, at present, the animal is too well known to admit of any doubt concerning it. The hog common in Guinea differs also in some things from our own; though shaped exactly as ours, it is of a reddish colour, with long ears which end in a sharp point, and a tail which hangs down to the pastern; the whole body is covered with short red shining hair, without any bristles, but pretty long near the tail. Their flesh is said to be excellent, and they are very tame.

---

[1] The most prominent domestic breeds of swine are the *Berkshire*, the *Chinese*, and the *Irish* breeds. The first of these, in a variety of modifications, is perhaps the most extensively spread and reared. The Chinese breed is commonly of a black colour, with small head, thin ears, and short and slender legs. It is very easily fattened. In the extreme north of Scotland and some of the islands, the race is diminutive. Those of Hampshire, Sussex, Suffolk, Cheshire, and Shropshire are much esteemed.

The astonishing fecundity of swine (says Mr Griffith) is one of their most obvious and remarkable characters. They live and multiply in every climate of the world, with the exception of the polar regions; accordingly we find that, though their natural life would, if permitted, extend to fifteen or twenty years, yet they are capable of reproduction from nine months or a year old. Their lubricity is extreme, and even furious. The rut is almost perpetual, and the female even in a state of pregnancy, will seek the male. It is even said that she will occasionally admit the advances of a male of a different species. The production of fifteen or twenty in a litter is not unfrequent, and instances have been known even of thirty-seven. The celebrated Vauban has made a calculation of the probable production of an ordinary sow, during the space of ten years. He has not comprehended the male pigs in his estimate, though they may reasonably be supposed as numerous as the females in each litter. Moreover, six young ones only, male and female, have been allowed to each, though generally they are more numerous. The result is, that the product of a single sow in eleven years, which are equivalent to ten generations, will be six million four hundred and thirty-four thousand eight hundred and thirty-eight pigs. Taking it however in round numbers, and allowing for accident, disease, and the ravages of wolves, four hundred and thirty-four thousand eight hundred and thirty-eight, there will remain six million of pigs, which is about the number existing in France. "Were we to extend our calculations," says Vauban, "to the twelfth generation, we should find as great a number to result as all Europe would be capable of supporting; and were they to be continued to the sixteenth, as great a number would result as would be adequate to the abundant peopling of the globe." A remarkable instance of the fecundity of these animals occurred in this country about twenty-eight years ago. A sow belonging to Mr Thomas Richdale, Kegworth, Leicestershire, had produced, in the year 1797, three hundred and fifty-five young ones in twenty litters; four years before, it brought forth two hundred and five in twelve litters, and afterwards it had eight litters more. The number produced in these last, added to the first, made the three hundred and fifty-five. In a cattle show held by the Highland Society at Glasgow, September 1838, a boar was exhibited only twenty months old, and the legitimate father of 1466 pigs.

In hot climates the flesh of swine is not good. M. Sonnini remarks, that in Egypt, Syria, and even in the southern parts of Greece, this meat, though very white and delicate, is so far from firm, and so surcharged with fat that it disagrees with the strongest stomachs. It is therefore considered unwholesome, and this will account for its proscription by the legislators and priests of the East. Such an abstinence was doubtless indispensable to health under the burning suns of Egypt and Arabia. The Egyptians were permitted to eat pork only once a-year, on the feast day of the moon, and then they sacrificed a number of these animals to that planet. At other times, if any one even touched a hog, he was obliged immediately to plunge into the Nile with his clothes on, by way of purification. The swine-herds formed an isolated class, the outcasts of society. They were interdicted from entering the temples or intermarrying with any other families. This aversion for swine has been transmitted to the modern Egyptians. The Copts rear no pigs, no more than the followers of Mahomet.

[2] British Zoology, vol. i. p. 44.

[3] Amœnit. Acad. vol. v. p. 465.

All these, from their near resemblance to the hog, may be considered as of the same species; the East Indian hog, we well know, breeds with the common kind; whether the same obtains between it, and those of Upsal and Guinea, we cannot directly affirm; but where the external similitude is so strong, we may be induced to believe that the appetites and habits are the same. It is true, we are told, that the Guinea breed will not mix with ours, but keep separate, and herd only together; however, this is no proof of their diversity, since every animal will prefer its own likeness in its mate; and they will only then mix with another sort, when deprived of the society of their own. These, therefore, we may consider as all of the hog kind; but there are other quadrupeds, that, in general, resemble this species, which nevertheless, are very distinct from them. Travellers, indeed from their general form, or from their habits and way of living, have been content to call these creatures hogs also; but upon a closer inspection, their differences are found to be such as entirely to separate the kinds, and make each a distinct animal by itself.

CHAP. II.

THE PECCARY, OR TAJACU.[1]

THAT animal which of all others most resembles the hog, and yet is of a formation very distinct from it, is called the *peccary*, or *tajacu*. It is a native of America, and found there in such numbers, that they are seen in herds of several hundreds together, grazing

---

[1] The peccaries, although bearing a close affinity both in external form and internal structure to the common hog, are nevertheless distinguished from that well known beast by several striking characters, of sufficient importance, when taken in conjunction with their transatlantic origin, to justify their separation as a distinct genus. The most essential of these characters consist in the number and direction of their teeth, the structure of their hinder feet, the form of their head and snout, the shortness and flatness of their tail, and the existence of a peculiar glandular apparatus. They have in the upper jaw four incisor teeth instead of six, the number found in the pigs of the old world; and six in the lower. Of these the two outer are separated from the intermediate ones by a vacant space, and are smaller in size and of a more conical form. Before the canines of each jaw there occurs another interval, which is occupied in the upper, when the mouth is closed, by the canine of the lower; while that of the upper projects from the mouth in the form of a tusk, and is not received into any corresponding groove. These teeth are from an inch to an inch and a quarter in length, strong, thick, and triangular. They are succeeded by a third interval, behind which, on each side of either jaw, are ranged six nearly equal molars, instead of seven, the number met with in the common hog.

In the latter all the feet are well known to be formed of two anterior toes, and these are properly speaking intermediate between two others which take a backward direction, are much smaller in size, and placed so much above the level of the foot as seldom to touch the ground in walking. The same structure is observed in the peccaries, with the exception that on their hind feet the outer one of the smaller or posterior toes is entirely wanting, and they have consequently but three toes instead of four. Their head is shorter and broader than that of the hog; but the movable snout by which their face is terminated is proportionally longer, and its flat and truncated extremity is bordered by a more expanded margin. The legs are also slenderer in their proportions; and the tail, which is scarcely visible among the bristles, instead of being taper, conical, and curled upwards, is extremely short, remarkably flat, and completely pendulous. But the most striking distinction between them and every other known species of quadruped appears to consist in a large gland placed immediately beneath the skin on the middle of the loins, and readily discernible on turning up the long bristles by which it is covered. This operation is, however, far from pleasant, and is besides by no means indispensible; the filthy and disgusting smell emitted by the fluid which is secreted by the gland in large quantities, furnishing of itself a sufficient and to any sensible nostril a perfectly satisfactory indication of its existence.

The peccaries resemble the common hog not more in their form and structure than in their habits, disposition, and propensities. Their gait is almost precisely similar; they burrow in the earth after the same fashion; eat and drink in the same swinish manner; are fond of the same description of food; elevate their long bristles like him when terrified or angry; breathe with the same violent effort; and express their feelings with the same peculiar grunt. They are also equally susceptible of domestication; or perhaps we should rather say much more so, if we adopt the wild boar of Europe as the type of the domesticated race. When taken young they readily become habituated to the society of man; take as much delight as our pigs in being scratched and scrubbed; and are speedily reduced to a state of complete subservience. They are not, however, likely ever to become so useful in the farm-yard, for not to speak of their fetid gland, which is said to communicate a very disagreeable savour to their flesh if not removed immediately after death, the flesh itself is decidedly inferior to pork both in flavour and fatness: their productiveness also bears no comparison to that of the sow, the female bringing forth but once a year and producing no more than two young ones at a birth. The experiment of breeding them has, however, we are informed, been tried in various parts of the continent of South America, and in some of the West India islands; but we are not aware of the extent to which it has succeeded, or whether the project has not been altogether laid aside.

Both the species of this group (the collared peccary and the white lipped peccary) appear to be more or less common throughout the whole of South America. They inhabit only the thickest and most extensive forests, and take up their dwellings in the hollows of trees or in burrows formed in the earth by other animals. They are rarely found in any considerable numbers in the neighbourhood of villages, but sometimes commit great devastation among the sugar-canes, the maize, the manihot, and the potatoe crops. They are generally said to be among the woods, and inoffensive, except when offended.

The peccary, at first view, resembles a small hog; the form of its body, the shape of its head, the length of its snout, and the form of its legs, are entirely alike: however, when we come to examine it nearer, the differences begin to appear. The body is

---

extremely savage; but the difference between the two species in this respect, as well as in various other particulars of manners and disposition, appears to be even more strongly marked than that which distinguishes their external form.

The *collared peccary* is the Patira of Sonnini, and the Taytêtou of D'Azara, who first clearly established the difference between the two species. (For a representation of it, see Plate XIV. fig. 3.) It is smaller than the other, seldom measuring fully three feet in length, and rarely weighing more than fifty pounds. Its general colour is a yellowish gray, resulting from the manner in which the bristles are marked by alternate rings of grayish straw-colour and black. A row of long black bristles extends backwards from between the ears, forming a somewhat erectile mane on the back of the neck, and becoming gradually longer as they approach the tail. The face is more grizzled with yellow than any other part, with the exception of a narrow oblique line of yellow-pointed hairs, which passes from behind the shoulders to the fore part of the neck, and from which the specific name of the animal is derived. The colour of the legs, as well as of the hoofs which envelope the extremities of the toes, is nearly black. The head is extremely long, the profile forming almost a straight line from between the ears to the extremity of the nose, which projects considerably beyond the mouth, is very moveable, and terminates abruptly in a broad and flat expansion, in which the large open nostrils are placed far apart from each other. The ears are small, upright, nearly naked, and of a grayish colour. On the legs and muzzle the hairs are extremely short. The colour of the young ones is for the first year of a uniform reddish brown. The collared peccary is not a migratory animal. It generally passes its life in the forest in which it first saw the light, where it is usually met with in pairs or in small families. They subsist for the most part on vegetable food, chiefly roots, which they procure by burrowing in the earth. They will, however, sometimes feed upon fish and reptiles, and are said to be dexterous in destroying serpents. Their peculiar grunt is heard at a considerable distance; but they are more easily traced by the nose than by the ear.

The *white-lipped peccary*, according to M. Sonnini, is exclusively known in Guiana by the name of Peccary, although that denomination is now commonly applied in Europe to both it and the patira, or collared peccary, of the same country. It is also the Tagnicati of M. D'Azara, from whom and from the author just quoted most of our information relative to the habits of these animals in their native land has been derived. In size it is considerably larger than the other species, frequently measuring three feet and a half in length, and sometimes attaining the weight of a hundred pounds. In form and proportions it is thicker and stouter, with shorter legs, and a longer snout; and the abrupt termination of that part is still more expanded and flattened out than that of the collared peccary. In its colour it has little of the grayish tinge which characterizes the latter, the black hairs of the back and sides having only a few brownish rings, which are rather more thickly spread on the sides of the head beneath the ears. These organs are less remarkable than in the other species in consequence partly of the greater length of the mane, which advances forwards between them, and is continued down the back towards the tail, the bristles of which it is composed being very thick and somewhat flattened. The whiskers consist of long black scattered bristles: and a few others of a similar description project just above the eyes. The whole of the under lip, together with the sides of the mouth and the upper surface of the nose, are white. The legs and hoofs are black; and the latter are long and narrow, the posterior one of the hinder feet almost touching the ground. The tusks are longer and more visible externally than in the patira. In the young animal the livery is more varied, being in some degree striped like that of the young wild boar of Europe; but these stripes are lost by degrees as the animal advances in age, and few traces of them remain after the first year.

Unlike the former species the white-lipped peccaries congregate in numerous bands, sometimes amounting, it is said, to more than a thousand individuals of all ages. Thus united they frequently traverse extensive districts, the whole troop occupying an extent of a league in length, and directed in their march, if the accounts of the natives are to be credited, by a leader, who takes his station at the head of the foremost rank. Should they be impeded in their progress by a river, the chief stops for a moment, and then plunges boldly into the stream, and is followed by all the rest of the troop. The breadth of the river or the rapidity of the current appear to be but trifling obstacles in their way, and to be overcome with the greatest facility. On reaching the opposite bank they proceed directly on their course, and continue their march even through the plantations which, unfortunately for the owners, may happen to lie in their way; and which they sometimes completely devastate by rooting in the ground for their favourite food, or devouring such fruits as they find there. If they meet with any thing unusual on their way, they make a terrific clattering with their teeth, and stop and examine the object of their alarm. When they have ascertained that there is no danger, they continue their route without further delay; but if a huntsman should venture to attack them when they are thus assembled in large numbers, he is sure to be surrounded by multitudes and torn to pieces by their tusks, if he is so unwise as to neglect his only chance of escape, which consists in climbing a tree, and thus getting fairly out of their reach. The smaller bands are by no means equally courageous, and always take to flight at the first attack.

M. Sonnini relates that he was often, in the course of his travels in Guiana, surrounded by a troop of peccaries infuriated with the havoc made by the muskets of himself and his companions. Mounted upon a tree he was enabled to observe their motions, and to notice the manner in which they encouraged by their grunts and by the rubbing of their snouts together those among them who were injured by the shots which were poured upon them from above. With erected bristles and eyes sparkling with rage, they still maintained their ground; and it was sometimes only after two or three hours incessant firing that they were at last compelled to quit the field of battle, and to leave the bodies of the dead to the mercy of the conquerors. These days of victory over the peccaries, he adds, are always days of abundance for the traveller in those immense forests, who has no other resource except the chase. An enormous gridiron is immediately constructed with sticks fixed in the earth, and three feet in height, over which a quantity of small branches are placed in a transverse direction. On these the peccaries are deposited after being cut in pieces, and are cooked by a slow fire, which is kept up during the whole night. From the enthusiasm with which our author speaks of his desert feasts, and the regret which he expresses that he is no longer a sharer in them, we may readily imagine that, under the circumstances in which he partook not so bulky; its legs not so long; its bristles much thicker and stronger than those of the hog, resembling rather the quills of a porcupine than hair; instead of a tail, it has only a little fleshy protuberance, which does not even cover its posteriors; but that which is still more extraordinary, and in which it differs from all other quadrupeds whatsoever, is, that it has got upon its back a lump, resembling the navel in other animals, which is found to separate a liquor of a very strong smell. The peccary is the only creature that has those kind of glands which discharge the musky substance on that part of its body. Some have them under the belly, and others under the tail; but this creature, by a conformation peculiar to itself, has them on its back. This lump, or navel, is situated on that part of the back which is over the hinder legs; it is, in general, so covered with long bristles, that it cannot be seen, except they be drawn aside. A small space then appears, that is almost bare, and only beset with a few short fine hairs. In the middle it rises like a lump; and in this there is an orifice, into which one may thrust a common goose-quill. This hole or bag is not above an inch in depth; and round it, under the skin, are situated a number of small glands, which distil a whitish liquor, in colour, and substance resembling that obtained from the civet animal. Perhaps it was this analogy, that led Dr Tyson to say, that it smelt agreeably also, like that perfume. But this Mr Buffon absolutely denies; affirming, that the smell is at every time, and in every proportion, strong and offensive; and to this I can add my own testimony, if that able naturalist should want a voucher.

But to be more particular in the description of the other parts of this quadruped; the colour of the body is grizly, and beset with bristles, thicker and stronger than those of a common hog; though not near so thick as those of a porcupine, they resemble them in this respect, that they are variegated with black and white rings. The belly is almost bare; and the short bristles on the sides gradually increase in length, as they approach the ridge of the back, where some are five inches long. On the head also, between the ears, there is a large tuft of bristles that are chiefly black. The ears are about two inches and a half long, and stand upright; and the eyes resemble those of a common hog, only they are smaller. From the lower corner of the eye to the snout, is usually six inches; and the snout itself is like that of a hog, though it is but small. One side of the lower lip is generally smooth, by the rubbing of the tusk of the upper jaw. The feet and hoofs are perfectly like those of a common hog; but, as was already observed, it has no tail. There are some anatomical differences in its internal structure from that of the common hog. Dr Tyson was led to suppose, that it had three stomachs; whereas the hog has but one: however, in this he was deceived, as Mr Daubenton has plainly shown, that the stomach is only divided by two closings, which gives it the appearance as if divided into three; and there is no conformation that prevents the food in any part of it from going or returning to any other.

The peccary may be tamed like the hog, and has pretty nearly the same habits and natural inclinations. It feeds upon the same aliments; its flesh, though drier and leaner than that of the hog, is pretty good eating; it is improved by castration; and when killed, not only the parts of generation must be taken instantly away, but also the navel on the back, with all the glands that contribute to its supply. If this operation be deferred for only half an hour, the flesh becomes utterly unfit to be eaten.

The peccary is extremely numerous in all the parts of Southern America. They go in herds of two or three hundred together; and unite, like hogs, in each other's defence. They are particularly fierce when their young are attempted to be taken from them. They surround the plunderer, attack him without fear, and frequently make his life pay the forfeit of his rashness. When any of the natives are pursued by a herd in this manner, they frequently climb a tree to avoid them; while the peccaries gather round the root, threaten with their tusks, and their rough bristles standing erect, as in the hog kind, they assume a very terrible appearance. In this manner they remain at the foot of the tree for hours together; while the hunter is obliged to wait patiently, and not without apprehensions, until they think fit to retire.

The peccary is rather fond of the mountainous parts of the country, than the lowlands; it seems to delight neither in the marshes nor the mud, like our hogs; it keeps among the woods, where it subsists upon wild fruits, roots, and vegetables; it is also an unceasing enemy to the lizard, the toad, and all the serpent kinds, with which these uncultivated forests abound. As soon as it perceives a serpent, or a viper, it at once seizes it with its fore-hoofs and teeth, skins it in an instant, and devours the flesh. This is often seen, and may therefore be readily credited; but as to its applying to a proper vegetable immediately after, as an antidote to the poison of the animal it had devoured, this part of the relation we

---

of them, they must have been an exquisite treat. It does not, however, follow as a necessary consequence that in other places and at other times he might have been so well disposed to relish these delicacies of the forest.—*Menagerie of Zool. Soc. vol. I.*

may very well suspect. The flesh neither of the toad nor viper, as every one now knows, are poisonous; and, therefore, there is no need of a remedy against their venom. Ray gives no credit to either part of the account; however, we can have no reason to disbelieve that it feeds upon toads and serpents: it is only the making use of a vegetable antidote that appears improbable, and which perhaps had its rise in the ignorance and credulity of the natives.

The peccary, like the hog, is very prolific;[1] the young ones follow the dam, and do not separate till they have come to perfection. If taken at first, they are very easily tamed, and soon lose all their natural ferocity; however, they never show any remarkable signs of docility, but continue stupid and rude, without attachment, or even seeming to know the hand that feeds them. They only continue to do no mischief; and they may be permitted to run tame, without apprehending any dangerous consequences. They seldom stray far from home; they return of themselves to the sty; and do not quarrel among each other, except when they happen to be fed in common. At such times they have an angry kind of growl, much stronger and harsher than that of a hog; but they are seldom heard to scream as the former; only now and then, when frighted or irritated, they have an abrupt angry manner of blowing, like the boar.

The peccary, though like the hog in so many various respects, is, nevertheless, a very distinct race, and will not mix, nor produce an intermediate breed. The European hog has been transplanted into America, and suffered to run wild among the woods; it is often seen to herd among a drove of peccaries, but never to breed from them. They may therefore be considered as two distinct creatures: the hog is the larger and the more useful animal; the peccary, more feeble and local; the hog subsists in most parts of the world, and in almost every climate; the peccary is a native of the warmer regions, and cannot subsist in ours without shelter and assistance. It is more than probable, however, that we could readily propagate the breed of this quadruped; and that, in two or three generations, it might be familiarized to our climate; but as it is inferior to the hog in every respect, so it would be needless to admit a new domestic, whose services are better supplied in the old.

CHAP. III.

THE CAPIBARA, OR CABIAI.[2]

There are some quadrupeds so entirely different from any that we are acquainted with, that it is hard to find a well known animal to which to resemble them. In this case we must be content to place them near such as they most approach in form and habits, so that the reader may at once have some idea of the creature's shape or disposition, although perhaps an inadequate and a very confused one.

Upon that confused idea, however, it will be our business to work, to bring it by degrees to greater precision; to mark out the differences of form, and thus give the clearest notions that words can easily convey. The known animal is a kind of rude sketch of the figure we want to exhibit; from which by degrees we fashion out the shape of the creature we desire should be known; as a statuary seldom begins his work till the rude outline of the figure is given by some other hand.—In this manner, I have placed the capibara among the hog kind, merely because it is more like a hog than any other animal commonly known; and yet, more closely examined, it will be found to differ in some of the most obvious particulars.

The capibara resembles a hog of about two years old, in the shape of its body, and the coarseness and colour of its hair. Like the hog, it has a thick short neck, and a rounded bristly back; like the hog, it is fond of the water and marshy places, brings forth many at a time, and like it feeds upon animal and vegetable food. But when examined more nearly, the differences are many and obvious: the head is longer, the eyes are larger, and the snout, instead of being rounded, as in the hog, is split like that of a rabbit or hare, and furnished with thick strong whiskers; the mouth is not so wide, the number and the form of the teeth are different, for it is without tusks; like the peccary, it wants a tail; and, unlike to all others of this kind, instead of a cloven hoof, it is in a manner web-footed, and thus entirely fitted for swimming, and living in the water. The hoofs before are divided into four parts, and those behind into three; between the divisions there is a prolongation of the skin, so that the foot, when spread in swimming, can beat a greater surface of water.

---

[1] This, as will be seen from the previous note, is a mistake.

[2] The capibara is now removed into the genus *Cavia*, or cavy tribe, to which it undoubtedly belongs, as it has all the essential characters of a cavy. The name of Hog or Pig has been given to various animals which have no relation to the swine genus. Thus, the capibara is called the *water-hog;* the porpoise the *sea-hog;* the porcupine, the *iron-hog;* and the cochon, the *Guinea-Pig.*

As its feet are thus made for the water, so it is seen to delight entirely in that element; and some naturalists have called it the *water-hog* for that reason. It is a native of South America, and is chiefly seen frequenting the borders of lakes and rivers, like the otter. It seizes the fish, upon which it preys, with its hoofs and feet, and carries them to the edge of the lake to devour them at its ease. It lives also upon fruits, corn, and sugar canes. As its legs are long and broad, it is often seen sitting up like a dog that is taught to beg. Its cry more nearly resembles the braying of an ass, than the grunting of a hog. It seldom goes out, except at night, and that always in company. It never ventures far from the sides of the river or the lake in which it preys; for as it runs ill, because of the length of its feet and the shortness of its legs, so its only place of safety is the water, into which it immediately plunges when pursued, and keeps so long at the bottom that the hunter can have no hopes of taking it there. The capibara, even in a state of wildness, is of a gentle nature, and, when taken young, is easily tamed. It comes and goes at command, and even shows an attachment to its keeper. Its flesh is said to be fat and tender, but from the nature of its food, it has a fishy taste, like that of all those which are bred in the water. Its head, however, is said to be excellent; and in this it resembles the beaver, whose fore-parts taste like flesh, and the hinder like the fish that it feeds on.

CHAP. IV.

THE BABYROUSA,[1] OR INDIAN HOG.

The Babyrousa is still more remote from the hog kind than the capibara; and yet most travellers who have described this animal, do not scruple to call it the hog of Borneo, which is an island in the East Indies, where it is principally to be found. Probably this animal's figure, upon the whole, most resembles that of the hog kind, and may have induced them to rank it among the number; however, when they come to its description, they represent it as having neither the hair, the bristles, the head, the stature, nor the tail, of a hog. Its legs, we are told, are longer, its snout shorter, its body more slender, and somewhat resembling that of a stag; its hair is finer, of a gray colour, rather resembling wool than bristles, and its tail also tufted with the same. From these varieties, therefore, it can scarcely be called a hog; and yet in this class we must be content to rank it, until its form and nature come to be better known. What we at present principally distinguish it by, are four enormous tusks, that grow out of the jaws; the two largest from the upper, and the two smallest from the under. The jaw-bones of this extraordinary animal are found to be very thick and strong, from whence those monstrous tusks are seen to proceed that distinguish it from all other quadrupeds whatsoever. The two that go from the lower jaw are not above a foot long, but those of the uppor are above half a yard; as in the boar, they bend circularly, and the two lower stand in the jaw as they are seen to do in that animal; but the two upper rise from the upper jaw rather like horns than teeth; and, bending upwards and backwards, sometimes have their points directed to the animal's eyes, and are often fatal by growing into them. Were it not that the babyrousa has two such large teeth underneath, we might easily suppose the two upper to be horns; and, in fact, their sockets are directed upwards; for which reason Dr Grew was of that opinion; but as the teeth of both jaws are of the same consistence, and as they both grow out of sockets in the same manner, the analogy between both is too strong not to suppose them of the same nature. The upper teeth, when they leave the socket, immediately pierce the upper lips of the animal, and grow as if they immediately went from its cheek. The tusks in both jaws are of a very fine ivory, smoother and whiter than that of the elephant, but not so hard or serviceable.

These enormous tusks give this animal a very formidable appearance; and yet it is thought to be much less dangerous than the wild boar.[2] Like animals of the hog kind, they go together in a body, and are often seen in company with the wild boar, with which, however, they are never known to engender. They have a very strong scent, which discovers them to the hounds; and when pursued they growl dreadfully, often turning back upon the dogs, and wounding them with the tusks of the lower jaw, for those of the upper are rather an obstruction than a defence. They run much swifter than the boar, and have a more exquisite scent, winding the men and the dogs at a great distance. When hunted closely, they generally plunge themselves into the sea, where they swim with great swiftness and facility, diving and rising again at pleasure; and in this manner they most frequently escape their pursuers. Although fierce and terrible when offended, yet they are peaceable and harmless when left unmolested. They are very easily tamed, and their flesh is good to be eaten; but it is said to putrefy in a very short time. They have a way of reposing themselves different from most other animals of the larger kind; which is by hitching one of their upper tusks on the branch of a tree, and then suffering their whole body to swing down at ease. Thus suspended from a tooth, they continue the whole night quite secure, and out of the reach of such animals as hunt them for prey.

---

[1] Babyrousa signifies literally *Hog-Deer*.

[2] Buffon, vol. xxv. p. 179.

The babyrousa, though by its teeth and tusks it seems fitted for a state of hostility, and probably is carnivorous, yet nevertheless, seems chiefly to live upon vegetables and the leaves of trees. It seldom seeks to break into gardens, like the boar, in order to pillage the more succulent productions of human industry, but lives remote from mankind, content with coarser fare and security. It has been said, that it was only to be found in the island of Borneo; but this is a mistake, as it is well known in many other parts both of Asia and Africa, as at the Celebes, at Estrila, Senegal, and Madagascar.[1]

Such are the animals of the hog kind, which are not distinctly known; and even all these, as we see, have been but imperfectly examined or described.[2] There are some others of which we have still more imperfect notices; such as the warree, a hog of the Isthmus of Darien, described by Wafer, with large tusks, small ears, and bristles like a coarse fur all over the body. This, however, may be the European hog, which has run wild in that part of the new world, as no other traveller has taken notice of the same. The Canary boar seems different from other animals of this kind, by the largeness of its tusks; and, as is judged from the skeleton, by the aperture of its nostrils, and the number of its grinders. I cannot conclude this account of those animals that are thus furnished with enormous tusks, without observing that there is a strong consent between these and the parts of generation. When castrated, it is well known that the tusks grow much smaller, and are scarcely seen to appear without the lips; but what is still more remarkable is, that in a boar, if the tusks by any accident or design be broken away, the animal abates of its fierceness and venery, and it produces nearly the same effect upon its constitution as if castration had actually taken place.[3]

---

[1] Anderson's Natural History of Greenland.

[2] The *Tapirs* of America and the Asiatic islands, are classed by some naturalists among the hogs. They resemble more, in many points, the elephants and hippopotami, and will be found treated of in that portion of the work which embraces these animals.

[3] Lisle's Husbandry, vol. ii. p. 329.

A
HISTORY OF ANIMALS.

BOOK IV.

CARNIVOROUS ANIMALS.

CHAP. I.

ANIMALS OF THE CAT KIND.[1]

We have hitherto been describing a class of peaceful and harmless animals, that serve as the instruments of men's happiness, or, at least, that do not openly oppose him. We come now to a bloody and unrelenting tribe, that disdain to own his power, and carry on unceasing hostilities against him. All the class of the cat kind are chiefly distinguished

---

[1] The distinctive peculiarities, as well as the general designation, of the carnivorous tribes of quadrupeds, are indicative of their propensity to rapine; in other words, of that instinct which teaches them to prey upon the flesh of animals as their natural and most congenial food. We are consequently led to expect that the most highly organized and typical groups of that extensive order should exhibit this characteristic propensity in its utmost state of developement, and should be furnished with the most powerful means of carrying it into complete effect. Accordingly we find that in the genus *felis*, which comprehends the largest and the most ferocious of predatory beasts, the teeth and claws, the principal organs of destruction, are eminently fitted for the deadly purpose to which they are applied, and are accompanied by a corresponding developement of those accessory organs which assist them in their action.

The dentary system of the animals of this group consists of six small and nearly equal incisors in each jaw, disposed in an almost straight line in front of the mouth; of two canines bounding the series of incisors, those of the upper jaw of great length, strong, conical, sharp-pointed, slightly incurved, passing, as in all carnivorous beasts, when the mouth is closed, behind those of the lower, which scarcely differ from them in form, but are somewhat inferior in size and power; and of cheek-teeth, which require a more particular description. These are four in number in the upper jaw, and generally three in the lower; the two anterior in both series are smaller than the third, and furnished each with a single, somewhat conical, pointed, central process; the third in the lower forms two, and in the upper three, sharp-pointed lobes, with an additional internal tubercle in the latter; and the fourth, which is peculiar to the upper jaw and is placed within the posterior margin of the third, offers nothing more than a small transverse tubercle. The series is not absolutely uninterrupted, a vacancy being left between the two somewhat larger lateral incisors of the upper jaw and the canines, for the reception of the canines of the lower jaw, and the cheek-teeth being seldom placed in close apposition with each other or with the canines. The slightest inspection of these organs, and more especially of the canine and of the larger cheek-teeth (the latter of which may be denominated lacerators, a term equivalent to the French designation of *carnassiers*), is sufficient to prove that nothing can be better adapted to the purpose of tearing asunder the large masses of flesh which are swallowed by these animals without being subjected to the process of mastication, which their structure and the nature of their food renders at once unnecessary and impracticable.

To assist in the laceration of their food, the tongues of the cats are armed, especially towards the hinder part, with numerous close-set bristly or rather prickly papillæ, the points of which are directed backwards; and their palates offer a series of transverse ridges covered with rough and projecting tubercles. The opening of the mouth is of great extent in proportion to the size of the animals; a fact which is frequently illustrated in a striking manner in travelling exhibitions, the keepers of which are in the habit of thrusting their heads into the lions' mouths, to the no small amusement of some, and the almost equal terror of others, among the gaping spectators. The muscles which move the lower jaw are also of great bulk, and the point on which they immediately act is brought so far forwards, in consequence of the breadth and shortness of the muzzle, as to give them the highest degree of attainable force.

The claws of all the genuine species of felis are of considerable length, much curved, with sharp cutting edges, and finely pointed extremities. The edge and point of these destructive organs is preserved unimpaired by a particular provision, which enables them to be entirely withdrawn within sheaths appropriated for the purpose, enclosed within folds of the skin which covers the extremity of the toes. These are five in number on the forefeet and four on the hind; and are remarkably short and obtuse. Their under surface is furnished with several distinct callous tubercles, on which the animal rests in progression, no other part of the feet being applied to the ground. The cats are consequently truly and typically digitigrade; they possess no sole, and the part which corresponds with the heels of the majority of quadrupeds occupies in them a conspicuous station on the posterior part of their limbs, considerably above the tubercles at the base of the toes on which alone they tread. Their legs are short and by their sharp and formidable claws, which they can hide and extend at pleasure. They lead a solitary ravenous life, neither uniting for their mutual defence, like vegetable feeders, nor for their mutual support, like those of the dog kind. The whole of this cruel and ferocious tribe seek their food alone; and except at certain seasons, are even enemies to each other. The dog, the wolf, and the bear, are some times known to live upon vegetables or farinaceous food; but all of the cat kind, such as the lion, the tiger, the leopard, and the ounce, devour nothing but flesh, and starve upon any other provision.

They are, in general, fierce, rapacious, subtle, and cruel, unfit for society among each other, and incapable of adding to human happiness. However, it is probable that even the fiercest could be rendered domestic, if man thought the conquest worth the trouble. Lions have been yoked to the chariots of conquerors, and tigers have been taught to tend those herds which they are known at present to destroy: but these services are not sufficient to recompense for the trouble of their keeping; so that, ceasing to be useful, they continue to be noxious, and become rebellious subjects, because not taken under equal

---

muscular; and their joints rounded, supple, and in the highest degree flexible.

In the general outline of their form the cats exhibit a remarkable uniformity. They are all distinguished by the elongated, but not particularly slender, make of their bodies, which are much flattened on the sides; by their short thick necks, taking for the most part a nearly horizontal direction; and by the broad and rounded form of their heads, which are usually much larger in proportion in the males than in the females. Their hair is close, soft, generally smooth, and often beautifully sleek. Its colour is rarely uniform; the far greater number of the species having a tendency to assume a striped or spotted livery, which frequently exhibits such rich and varied markings as to render their furs extremely valuable. The tips of the ears in some of the species, and the extremity of the tail in others, are surmounted by pencils or tufts of longer and differently coloured hairs; but these are wanting in the majority. Their moustaches are generally of great length, and composed of numerous bristles, which appear to be of considerable use to these animals, the sense of feeling being concentrated in them, or rather in the nerves which communicate with them, in a remarkable degree. The removal of these appendages is consequently observed to produce, for a time at least, no little embarrassment. The tails of the different species vary greatly in proportionate length; they are, however, always cylindrical, and covered uniformly with hair of the same kind as that which invests the body.

In intellectual character these animals occupy a very inferior station; and fortunate it is that such is the case. Were it not for that degradation in their mental faculties, which renders them incapable of employing their physical powers in concert with each other, what ravages would they not be enabled to commit? What could resist their prodigious and destructive force, if that force were accompanied by the sagacity of the dog or even of the wolf? But it has been wisely provided that in the same proportion as these beasts advance in the accumulation of corporeal means of destruction, they should recede in those intellectual qualifications which might otherwise be made the means of devastating the creation, while they are the less necessary for their individual preservation.

Conscious of their own undisputed superiority which secures them against the attacks of other animals, they never associate together in troops, but each with his female partner occupies a solitary den, which is usually concealed in the depths of the forest. Hence, when pressed by hunger, they issue forth in search of their prey, which they rarely attack with open force; but stealing on with noiseless tread, or stationing themselves in ambush in such situations as appear suitable to their purpose, watch with indefatigable patience the approach of their victim. Their motions are peculiarly characteristic of their habits and mode of life. Incapable of long continued speed, their usual gait is slow, cautious, and stealthy, with their posterior limbs bent beneath them, and their ears distended to catch the most trifling noise. Guided by these organs, the internal structure of which is highly developed, they trace the sound of footsteps at an almost incredible distance, and direct themselves towards their prey with unerring certainty. In this quest the sense of smell, which they possess in a very low degree, affords them but little assistance: their sight, however, is good, and serves them equally well both by day and night, their extremely dilatable pupils adapting themselves with admirable precision to various intensities of light. To this object the frequently elongated form of their pupils, the generally yellow colour of the internal or choroid coat of their eyes, and the extent of their nictitating membranes must also essentially contribute.

No sooner is the object of their pursuit within reach of their attack, than suddenly bursting forth from their lurking place, or changing their slow and stealthy pace for a furious and overwhelming bound, they dart with the velocity of lightning upon their terrified victim. The great strength and extreme flexibility of their fore paws enable them at once to dash him to the earth, and to seize him with an irresistible grasp. They then proceed to rend him in pieces by the united efforts of their teeth and claws, and gorge themselves upon his lacerated flesh. It is only when fearful of being disturbed in their operations that they carry off the body from the spot where it has fallen; and even in such cases they never transfer it to their dens, but seek out some solitary place in which to glut their ravenous cravings. When satiated they quit the carcase, to which they never return, and retire to their dens to sleep off the effects of their gluttonous meal; not again to awake until their renovated appetite stimulates to a repetition of the murderous scene. Even their amours are accompanied with a degree of savage barbarity; and the female is not unfrequently called upon to protect their mutual offspring from the ravenous jaws of her male companion.

Next to their ferocity, the leading feature in the moral character of all the cats is suspicion. It is this which imparts, even to the largest and most powerful of the group, an air of wiliness and malignity, but ill assorting with their gigantic size and immense muscular power. Of this feeling they can never be entirely divested; it is sufficiently remarkable even in the domesticated race; but becomes still more obvious in those which are kept in a state of confinement, and which, however well they may appear reconciled to their condition, and how much soever they may seem attached to their keepers, are startled by the slightest unusual occurrence, and become restless, uneasy, and mistrustful, whenever any change, however trifling, takes place in the objects by which they are surrounded.—*Menagerie of Zoological Society Described. Vol. I.*

protection with the rest of the brute creation.

Other tribes of animals are classed with difficulty; have often but few points of resemblance; and, though alike in form, have different dispositions, and different appetites. But all those of the cat kind, although differing in size, or in colour, are yet nearly allied to each other; being equally fierce, rapacious, and artful; and he that has seen one has seen all. In other creatures there are many changes wrought by human assiduity; the dog, the hog, or the sheep, are altered in their natures and forms, just as the necessities, or the caprice of mankind, have found fitting; but all of this kind are inflexible in their forms, and wear the print of their natural wildness strong upon them. The dogs or cows vary in different countries, but lions or tigers are still found the same; the very colour is nearly alike in all; and the slightest alterations are sufficient to make a difference in the kinds, and to give the animal a different denomination.

The cat kind are not less remarkable for the sharpness and strength of their claws, which thrust forth from their sheath when they seize their prey, than for the shortness of their snout, the roundness of their head, and the large whiskers which grow on the upper lip.[1] Their teeth also, which amount to the number of thirty, are very formidable, but rather calculated for tearing their prey than for chewing it; for this reason they feed but slowly; and while they eat, generally continue growling, to deter others from taking a share. In the dog kind, the chief power lies in the under jaw, which is long, and furnished with muscles of amazing strength; but in these the greatest force lies in the claws, which are extended with great ease, and their gripe is so tenacious that nothing can open it. The hinder parts in all these animals are much weaker than those before; and they seem less made for strength than agility. Nor are they endued with the swiftness of most other animals; but generally owe their subsistence rather to catching their prey by surprise than by hunting it fairly down. They all seize it with a bound, at the same time expressing their fierce pleasure with a roar; and the first grasp generally disables the captive from all further resistance. With all these qualifications for slaughter, they, nevertheless, seem timid and cowardly, and seldom make an attack, like those of the dog kind, at a disadvantage; on the contrary, they fly when the force against them is superior, or even equal to their own; and the lion himself will not

---

[1] *Use of Cat's Whiskers.*—Every one has observed the whiskers of a cat; but few, perhaps, dream that they serve any valuable end. The following passage will prove the contrary:—Every one must have observed what are usually called the whiskers on a cat's upper lip. The use of these in a state of nature is very important. They are organs of touch. They are attached to a bed of close glands under the skin; and each of these long and stiff hairs is connected with the nerves of the lip. The slightest contact of these whiskers with any surrounding object, is thus felt most distinctly by the animal although the hairs are themselves insensible. They stand out on each side in the lion, as well as in the common cat; so that, from point to point, they are equal to the width of the animal's body. If we imagine therefore, a lion stealing through a covert of wood, in an imperfect light, we shall at once see the use of these long hairs. They indicate to him, through the nicest feeling, any obstacle which may present itself to the passage of his body: they prevent the rustle of boughs and leaves, which would give warning to his prey, if he were to attempt to pass through too close a bush; and thus, in conjunction with the soft cushions of his feet, and the fur upon which he treads (the retractile claws never coming in contact with the ground,) they enable him to move towards his victim with a stillness greater even than that of the snake, who creeps along the grass, and is not perceived till he is coiled round his prey.—*Library of Useful Knowledge.*

Reason of cats alighting on their feet in falling.—The instinct which all animals seem to possess in bringing the line of direction of the centre of pressure within the base, is admirable. It is this instinct which renders the wild goat and chamois so fearless of danger in the terrific leaps they make among alpine precipices, and which enables a cat always to alight on its feet in falling from heights that appear sufficient to render a fall fatal. Now, the operations of instinct, though in many points of view not a little miraculous, are always regulated by some ingenious principle, when that can be discovered; and in the instance of the cat always falling on her feet, it appears to me that the same principle operates which enables us to walk upright by regulating our centre of pressure, attending to the things around us. In learning to walk, we judge of the distances of objects which we approach by the eye, and by observing their perpendicularity determine our own. Hence it is that no one who is hoodwinked can walk in a straight line for a hundred steps together; and for the same reason most people become dizzy when they look from the summit of a tower or battlement much raised above the object, in the sphere of distinct vision. A whirling wheel, or the current of a rapid river, or the apparent motion of the sea on looking over the side of a fast-sailing ship, have often a similar effect. When a child can first stand erect on its legs, if you give his attention to a white handkerchief extended like a sail, he will stand firm; but the instant you move it, he will tumble down. It is for this reason that rope-dancers, who have a very narrow base upon which to maintain the line of direction perpendicular, keep their eye fixed upon a point of the framework upholding the rope, by which to regulate their centre of pressure; and for the same reason, those who perform difficult parts of balancing, keep their eye fixed on the top of the things balanced, to retain the line of direction within the base. It may be accordingly inferred, that the reason why a man loses his balance when tipsy, is, that his eyes roll so unsteadily as to prevent him regulating his balance by the things around him, while the muscular feelings that assist him when hoodwinked are also deranged. It would be curious to ascertain whether a cat, if rendered tipsy, would fall equally on her feet when dropped from a height as a sober cat. The difficulty of the experiment would lie in getting a cat to drink beer, wine, or spirits, all of which it greatly dislikes. I have no doubt, indeed, that it is by fixing the eye on the things around that a cat falling from a height regulates her centre of pressure, so as to fall on her feet venture to make a second attempt, where he has once been repulsed with success. For this reason, in countries that are tolerably inhabited, the lion is so cowardly, that he is often scared away by the cries of women and children.

The cat, which is the smallest animal of this kind, is the only one that has been taken under human protection, and may be considered as a faithless friend, brought to oppose a still more insidious enemy.[1] It is, in fact, the only animal of this tribe whose services can more than recompense the trouble of their education, and whose strength is not sufficient to make its anger formidable. The lion, or the tiger, may easily be tamed, and rendered subservient to human command; but even in their humblest, and most familiar moments, they are still dangerous since their strength is such, that the smallest fit of anger or caprice may have dreadful consequences. But the cat, though easily offended, and often capricious in her resentments, is not endowed with powers sufficient to do any great mischief. Of all animals, when young, there is none more prettily playful than the kitten; but it seems to lose this disposition as it grows old, and the innate treachery of its kind is then seen to prevail. From being naturally ravenous, education teaches it to disguise its appetites, and to watch the favourable moment of plunder; supple, insinuating, and artful, it has learned the arts of concealing its intentions till it can put them into execution; when the opportunity offers, it at once seizes upon whatever it finds, flies off with it, and continues at a distance till it supposes its offence forgotten. The cat has only the appearance of attachment; and it may easily be perceived, by its timid approaches, and side-long looks, that it either dreads its master, or distrusts his kindness; different from the dog, whose caresses are sincere, the cat is assiduous rather for its own pleasure than to please; and often gains confidence only to abuse it. The form of its body, and its temperament, correspond with its disposition; active, cleanly, delicate, and voluptuous, it loves its ease, and seeks the softest cushions to lie on. "Many of its habits, however, are rather the consequences of its formation, than the result of any perverseness in its disposition; it is timid and mistrustful, because its body is weak, and its skin tender; a blow hurts it infinitely more than it does a dog, whose hide is thick, and body muscular; the long fur in which the cat is clothed entirely disguises its shape, which, if seen naked, is long, feeble, and slender; it is not to be wondered, therefore, that it appears much more fearful of chastisement than the dog, and often flies even when no correction is intended. Being also a native of the warmer climates, as will be shown hereafter, it chooses the softest bed to lie on, which is always the warmest."

The cat goes with young fifty-six days, and seldom brings forth above five or six at a time. The female usually hides the place of her retreat from the male, who is often found to devour her kittens. She feeds them for some weeks with her milk, and whatever small animals she can take by surprise, accustoming them betimes to rapine. Before they are a year old, they are fit to engender; the female seeks the male with cries; nor is their copulation performed without great pain, from the narrowness of the passage in the female. They live to about the age of ten years; and during that period they are extremely vivacious, suffering to be worried a long time before they die.

The young kittens are very playful and amusing; but their sport soon turns into malice, and they, from the beginning, show a disposition to cruelty; they often look wistfully towards the cage, sit centinels at the mouth of a mouse-hole, and in a short time become more expert hunters than if they had received the instructions of art. Indeed, their disposition is so incapable of constraint, that all instruction would be but thrown away. It is true, that we are told of the Greek monks of the isle of Cyprus teaching cats to hunt the serpents with which the island is infested; but this may be natural to the animal itself, and they might have fallen upon such a pursuit without any instruction. Whatever animal is much weaker than themselves, is to them an indiscriminate object of destruction. Birds, young rabbits, hares, rats, and mice, bats, moles, toads, and frogs, are all equally pursued; though not, perhaps, equally acceptable. The mouse seems to be their favourite game; and, although the cat has the sense of smelling in but a mean degree, it, nevertheless, knows those holes in which it resides. I have seen one of them patiently watch a whole day until the mouse appeared, and continue quite motionless until it came within reach, and then seize it with a jump. Of all the marks by which the cat discovers its natural malignity, that of playing and sporting with its little captive, before killing it outright, is the most flagrant.

The fixed inclination which they discover

She is, however, aided in this by the form of her body, somewhat the reverse of that of a grey-hound, the centre of pressure lying far back from the head, and, consequently, bringing down the hind feet rather before the fore feet.—*Rennie's Alphabet of Physics or Natural Philosophy.*

[1] This description is nearly translated from Mr Buffon; what I have added is marked with inverted commas.—*Note by Goldsmith.*

for this peculiar manner of pursuit, arises from the conformation of their eyes. The pupil in man, and in most other animals, is capable but of a small degree of contraction and dilatation, it enlarges a little in the dark, and contracts when the light pours in upon it in too great quantities. In the eyes of cats, however, this contraction and dilatation of the pupil is so considerable, that the pupil, which by day light appears narrow and small like the black of one's nail, by night expands over the whole surface of the eyeball, and, as every one must have seen, their eyes seem on fire. By this peculiar conformation, their eyes see better in darkness than light; and the animal is thus better adapted for spying out and surprising its prey.

Although the cat is an inhabitant of our houses, yet it cannot properly be called a dependent; although perfectly tame, yet it acknowledges no obedience; on the contrary, it does only just what it thinks fit, and no art can control any of its inclinations. In general, it is but half tamed; and has its attachments rather to the place in which it resides, than to the inhabitant. If the inhabitant quits the house, the cat still remains; and if carried elsewhere, seems for a while bewildered with its new situation. It must take time to become acquainted with the holes and retreats in which its prey resides, with all the little labyrinths through which they often make good an escape.

The cat is particularly fearful of water, of cold, and of ill smells. It loves to keep in the sun, to get near the fire, and to rub itself against those who carry perfumes. It is excessively fond of some plants, such as valerian, marum, and cat-mint: against these it rubs, smells them at a distance, and, at last, if they be planted in a garden, wears them out.

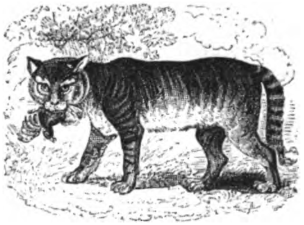
This animal eats slowly, and with difficulty, as its teeth are rather made for tearing, than chewing its aliments. For this reason it loves the most tender food, particularly fish, which it eats as well boiled as raw. Its sleeping is very light; and it often seems to sleep, the better to deceive its prey. When the cat walks it treads very softly, and without the least noise; and as to the necessities of nature, it is cleanly to the last degree. Its fur also is usually sleek and glossy; and, for this reason, the hair is easily electrified; sending forth shining sparks, if rubbed in the dark.

"The wild cat breeds with the tame;[1] and, therefore, the latter may be considered only as a variety of the former,[2] however, they differ in some particulars: the cat, in its savage state, is somewhat larger than the house-cat; and its fur being longer, gives it a greater appearance than it really has; its head is big-

---

[1] British Zoology.

[2] That the genuine wild cat of the British islands is specifically distinct from our *domestic race*, is now universally admitted. At the same time it often happens that individuals of our domestic breed betake themselves to the woods, or to extensive preserves of game, where, finding their supply of food abundant, they permanently establish themselves, and lead an independent life. Such emancipated individuals as these must not be confounded with the genuine wild cat, an animal essentially distinct, and an aboriginal of our island. We hear it often asserted that the *wild* and *tame* cat breed together, but there is every reason to believe that the *wild cat* in this case is one of the domestic species, leading an independent life. Such have frequently come under our own cognizance;—we have known them haunt coppices and woods in the vicinity of farm houses, and commit extensive ravages among the poultry and pigeons. The grounds upon which the specific distinctions between the domestic cat and the wild cat is now admitted, consist in their decided difference of general conformation; besides standing higher on the limbs, the body of the *wild cat* is much more robust than in the tame; the tail is shorter, and instead of tapering, terminates somewhat abruptly, being even fuller at its extremity than at its base; it is also invariably tipped with black. The lips and soles of the feet are also black.



The marked differences in form, colour, and general aspect of the *domestic cat*, as compared with the wild species, are palpable and striking. In the domestic cat the head is moderate in size and delicately formed, the body slender and graceful, and the tail long and tapering to a point at the extremity, the limbs being much shorter in comparison with the length of the body than in the wild cat. The fur of the domestic cat is very varied, both in form and hue, ranging from the entirely pure white through every shade of gray and ruddy fawn, and every form of stripe and spot, to the unmixed black, the arrangement of the colours and their markings being extremely beautiful, as in the pure tortoise-shell cat. Of the original introduction of the domestic cat into our island we have no information; but we know that, at an early period in England, the domestic cat was highly valued, a circumstance strongly corroborative of the specific distinction between it and the wild cat, which, though now comparatively rare, was formerly, while England was but partially cleared of the dense forests which once covered it, extremely abundant, insomuch that the procuring of young litters could have been of little difficulty.

The origin of our domestic cat is attributed by M. Temminck to a species indigenous in Nubia, Abyssinia, and Northern Africa, and known under the scientific name of *Felis maniculata*. However this may be, the domestic cat was among the sacred animals of the Egyptians; it was kept in their temples, is figured on the remains of Egyptian monuments, and its mummies are found in the tombs,—circumstances leading to a plausible hypothesis that its first domestication is to be attributed to that people, and that it is an aboriginal of the country adjacent to Egypt, or of Egypt itself.

ger, and face flatter; the teeth and claws much more formidable; its muscles very strong, as being formed for rapine; the tail is of a moderate length, but very thick and flat, marked with alternate bars of black and white, the end always black; the hips and hind part of the lower joints of the leg, are always black; the fur is very soft and fine: the general colour of these animals, in England, is a yellowish white, mixed with a deep gray. These colours, though they appear at first sight confusedly blended together, yet, on a close inspection, will be found to be disposed like the streaks on the skin of the tiger, pointing from the back downwards, rising from a black list, that runs from the head, along the middle of the back, to the tail. This animal is found in our larger woods; and is the most destructive of the carnivorous kinds in this kingdom. It inhabits the most mountainous and woody parts of these islands, living mostly in trees, and feeding only by night. It often happens, that the females of the tame kind go into the woods to seek mates among the wild ones. It should seem, that these, however, are not original inhabitants of this kingdom, but were introduced first in a domestic state, and afterwards became wild in the woods, by ill usage or neglect. Certain it is, the cat was an animal much higher in esteem among our ancestors than it is at present. By the laws of Howel, the price of a kitten, before it could see, was to be a penny; till it caught a mouse, two-pence; and when it commenced mouser, four-pence; it was required, besides, that it should be perfect in its senses of hearing and seeing, be a good mouser, have the claws whole, and be a good nurse. If it failed in any of these qualities, the seller was to forfeit to the buyer the third part of its value. If any one stole or killed the cat that guarded the prince's granary, he was to forfeit a milch ewe, its fleece and lamb, or as much wheat as when poured on the cat, suspended by the tail, (the head touching the floor,) would form a heap high enough to cover the tip of the former. From hence we discover, besides a picture of the simplicity of the times, a strong argument that cats were not naturally bred in our forests. An animal that could have been so easily taken, could never have been rated so highly; and the precautions laid down to improve the breed, would have been superfluous, in a creature that multiplies to such an amazing degree.

"In our climate, we know but of one variety of the wild cat; and, from the accounts of travellers, we learn, that there are but very few differences in this quadruped in all parts of the world. The greatest difference, indeed, between the wild and the tame cat, is rather to be found internally than in their outward form. Of all other quadrupeds, the wild cat is, perhaps, that whose intestines are proportionably the smallest and the shortest. The intestines of the sheep, for instance, unravelled out, and measured according to their length, will be found to be above thirty times the length of its body; whereas the wild cat's intestines being measured out, will not be

---

The wild cat, thus established as distinct from the tame breed, is found throughout the whole of Europe, wherever extensive woods afford it an asylum: it is common in the forests of Germany, Hungary, Russia, and the western parts of Asia; and, though scarce, is not extirpated in the British islands. Its chief strongholds are among the mountains of Scotland, and of the northern counties of England, and of Wales and Ireland, the larger woods being its place of resort, and of concealment by day. Here it lurks on the branches of large trees, in the hollows of decayed trunks, and in the clefts and holes of rocks, issuing forth at night to seek its prey; on hares, rabbits, grouse, partridges, and all kind of game, it commits sad havoc, and the feathers of its victims, scattered about, often betray its presence in the neighbourhood, and rouse the indignation of the gamekeeper, who lets pass no opportunity of destroying such noxious "vermin." Young lambs and fawns are by no means safe from its attack; indeed of all our native beasts of prey, at present living within the precincts of our island, it is the fiercest and most destructive. Pennant calls it the "British tiger," and if it has not the strength and size of the tiger it has all its ferocity. The destruction of the wild cat is not altogether destitute of danger; for when hard pressed, or enraged by a wound too slight to disable it, it darts fiercely on its opponent, aiming chiefly at the face and eyes, and using both claws and teeth with vindictive fury; it clings on to the last, tearing and rending until fairly despatched, its assailant bearing severe marks of the fray.

The size to which this species attains is sometimes very great. Bewick says that he recollects one killed in the county of Cumberland which measured, from the nose to the end of the tail, upwards of five feet. For ourselves we have never seen an individual of such dimensions, and are inclined to suspect a mistake: the males, which exceed the females, are seldom more than three feet in length, of which the tail occupies about a third. An enraged cat of even these dimensions is no trifling antagonist; like all the smaller *felinæ*, however, the present species shuns the face of man, and does not willingly hazard an encounter. The female pertinaciously defends her young, and while she is engaged with her progeny it is not very safe to disturb her in her retreat: she usually produces four or five at a birth, making a bed for them in a hollow tree or the fissure of a rock, and sometimes she even usurps the nest of a large bird in which to rear her young.

The fur of the wild cat is full and deep; on the face it is of a yellowish grey colour, passing into greyish brown on the head; several interrupted black stripes extend from the forehead, and pass between the ears to the occiput; the general colour of the body is dark grey, a dusky black stripe running down the spine, while beautiful transverse wavings of an obscure blackish brown adorn the sides; the tail is ringed with the same tint, except at the tip, which is black.

Fine specimens of the male and female wild cat, killed in Scotland, are in the museum of the Zoological Society; as is also a specimen of the *felis maniculata*, the alleged origin of our domestic breed. A comparison of these species together is one of much interest.

found above three times the length of its body. This is a surprising difference; but we may account for it, from the nature of the food in the two animals: the one living upon vegetables, which require a longer, and a more tedious preparation, before they can become a part of its body; the other living upon flesh, which requires very little alteration, in order to be assimilated into the substance of the creature that feeds upon it. The one, therefore, wanted a long canal for properly digesting and straining its food; the other but a short one, as the food is already prepared to pass the usual secretions: however, a difficulty still remains behind; the intestines of the wild cat are, by one-third, shorter than those of the tame. How can we account for this? If we say that the domestic cat, living upon more nourishing and more plentiful provision, has its intestines enlarged to the quantity with which it is supplied, we shall find this observation contradicted in the wild boar and the wolf, whose intestines are as long as those of the hog or the dog, though they lead a savage life, and, like the wild cat, are fed by precarious subsistence. The shortness, therefore, of the wild cat's intestines, is still unaccounted for; and most naturalists consider the difficulty as inexplicable. We must leave it, therefore, as one of those difficulties which future observation or accident are most likely to discover."

This animal is one of those few which are common to the new continent, as well as the old. When Christopher Columbus first discovered that country, a hunter brought him one, which he had discovered in the woods: it was of the ordinary size, the tail very long and thick. They were common also in Peru, although they were not rendered domestic. They are well known also in several parts of Africa, and many parts of Asia. In some of these countries they are of a peculiar colour, and inclining to blue. In Persia, Pietro della Valle informs us, that there is a kind of cat, particularly in the province of Chorazan, of the figure and form of the ordinary one, but infinitely more beautiful in the lustre and colour of its skin. It is of a gray blue, without mixture, and as soft and shining as silk. The tail is very long, and covered with hair six inches long, which the animal throws upon its back, like the squirrel. These cats are well known in France; and have been brought over into England, under the name of the *blue cat*, which, however, is not their colour.

Another variety of this animal is called by us the *lion cat;* or, as others more properly term it, the *cat of Angora.* These are larger than the common cat, and even than the wild one. Their hair is much longer, and hangs about their head and neck, giving this creature the appearance of a lion. Some of these are white, and others of a dun colour. These come from Syria and Persia, two countries which are noted for giving a long soft hair to the animals which are bred in them. The sheep, the goats, the dogs, and the rabbits, of Syria, are all remarkable for the fine glossy length and softness of their hair; but particularly the cat, whose nature seems to be so inflexible, conforms to the nature of the climate and soil, loses its savage colour, which it preserves almost in every other part of the world, and assumes the most beautiful appearance. There are some other varieties in this animal, but rather in colour than in form;[1] and, in

---

[1] We have many varieties of colour, (says Mr Rhind,) in the domestic cat: the principal of which are, a deep glossy black without a single white mark— a black and white variously arranged—a black yellow, and white, as in the tortoise-shell cat, where the ground colour is white, and the black, or brown and yellow, beautifully intermixed with streaks or clouded spots—a pure white —a yellow and white—a dun colour, or tawny, either plain or with stripes of a deeper colour—a tabby, or greyish brown, with brown or black streaks—a slate-coloured or blue grey (called the Chartreaux cat) generally of a large size—a slate-coloured, with very long fur, especially on the neck and tail (the Persian cat)—a white, with long hair (called the Angora cat)—the red cat of Tobolsk, and the hanging-eared cat of China. Sir Stamford Raffles mentions a variety of the domestic cat in Java, which has a twisted or knobbed tail, and sometimes is entirely destitute of this appendage. A tailless cat, common in Cornwall and the Isle of Wight, is mentioned by Dr Leach. Shaw also notices a variety with pencilled or tufted ears like a lynx, which, he says, is rare, and which we have never seen. Of these varieties, the most singular are the Persian and Angora; the latter has sometimes one eye blue and the other yellow. We have seen some cats with double ears, consisting of miniature convolutions at the outer corner of the external auricle.

In treating of the moral qualities of the cat, we are aware that we are touching on debateable ground. While some bestow upon poor puss all the epithets of treachery, cruelty, and ingratitude, others, finding in its disposition, kindness, gentleness, and playfulness, are warm in eulogies of their favourite. In fact, the character of the cat is judged of too much by comparison, and thus, like many persons in the world, its stock of really good qualities are thrown into the back ground, and all its bad propensities magnified. That the cat has not the sagacity, approaching almost to human reason, of the dog— that it has not his devotedness of affection, his entire self-control and patient submissiveness under the rebuke of his master—is not to be denied, nor, from its natural inherent habits, is it to be expected, that it should have these qualities to the same extent. Neither can it be affirmed that the cat is in disposition to be estimated like the noble and patient horse, another of the chief and favourite companions of man. Yet puss is not only the affectionate sharer of the clean and quiet hearth of the lonely widow, but it will be found quietly reposing on the silken covered cushion in the boudoir of the more wealthy; and from the palace to the cottage it every where finds its patrons, to whom its gambols and its fawnings, the beauty and symmetry of its elegant figure, and its graceful motions, are all circumstances of recommendation. In fact, it is bad usage alone that calls forth the savage propensities of this feline domestic; with gentle general, it may be remarked, that the cat, when carried into other countries, alters but very little, still preserving its natural manners, habits, and conformation.

THE LION.

The influence of climate upon mankind is very small;[1] he is found to subsist in all parts of the earth, as well under the frozen poles, as beneath the torrid zone; but in animals, the climate may be considered as congenial, and a kind of second nature. They almost all have their particular latitudes, beyond which they are unable to subsist; either perishing with a moderate cold, or dying for want of a frozen air, even in a temperate climate. The rein-deer is never seen to depart from the icy fields of the north; and on the contrary, the lion degenerates, when taken from beneath the line. The whole earth is the native country of man; but all inferior animals have each their own peculiar districts.

Most terrestrial animals are found larger, fiercer, and stronger in the warm, than in the cold or temperate climates. They are also more courageous and enterprising; all their dispositions seeming to partake of the ardour of their native soil. The lion produced under the burning sun of Africa, is of

---

and kind treatment, it can be as gentle, and kind, and insinuating, as any other animal. It is true, even in its most domestic state, it exhibits a native propensity for prey, and hence is derived its usefulness: though fed with the most delicate dainties, it will still prefer, as a peculiar delicacy, a mouse, caught by its own prowess and cunning, and it will revel in the quivering flesh of the yet gasping victim. Still nothing can exceed the affection of the cat to those who treat it kindly. This affection it expresses by rubbing its body close on the individual, and by the loud purring noise indicative of its satisfaction. It will not, however, bear to be crossed; and though it returns kindness by every expression in its power, it is also prompt to retaliate on the slightest opposition. Neither has it the perception of the dog, in desisting from any action when commanded to do so; it will persist in clawing food off one's plate, and has no hesitation in stealing whenever it can. Although the cat can be made to perform some actions at the command of its master, such as leaping, and other tricks, yet it does so always with reluctance, and has by no means the teachable and persevering disposition of the dog.

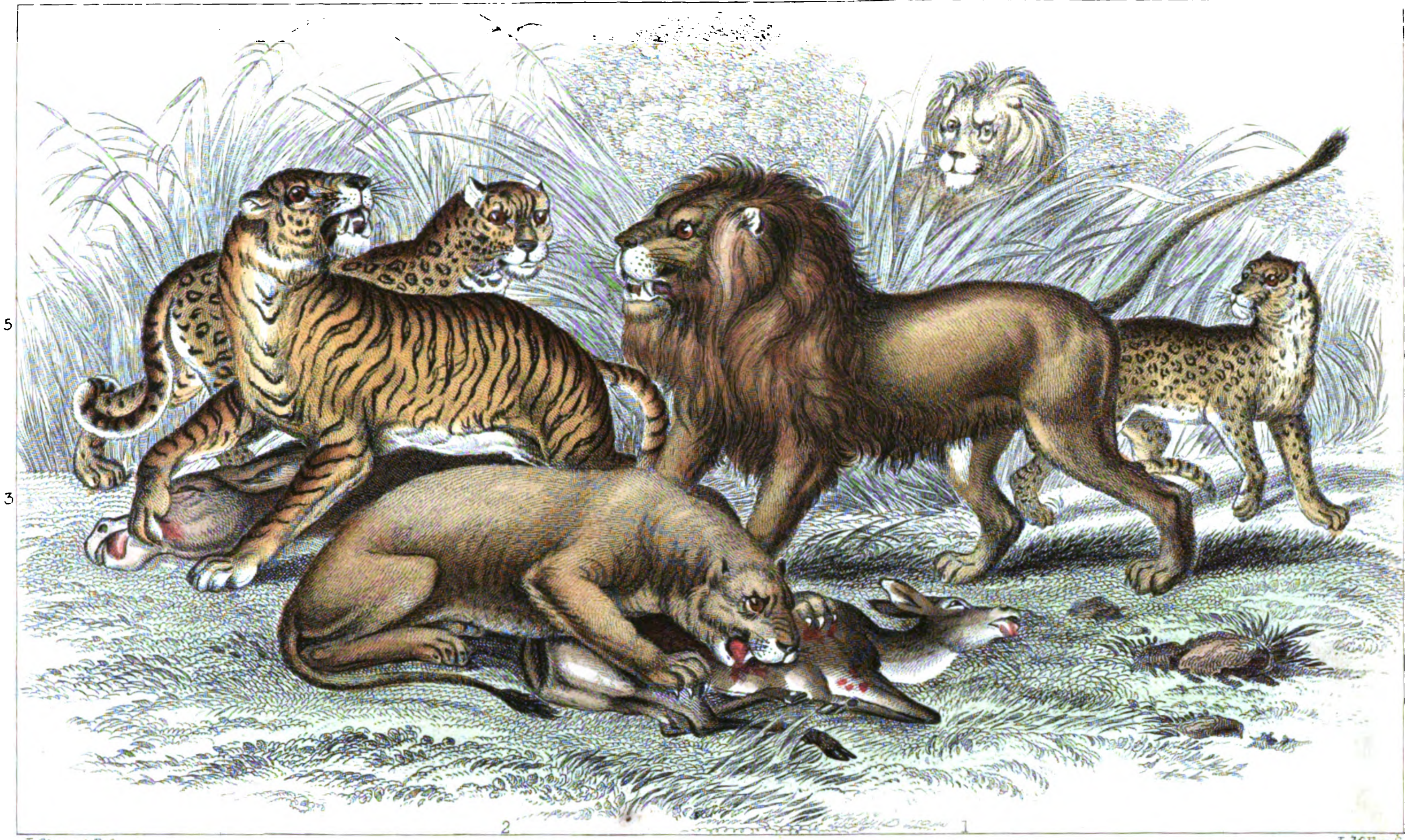
In the manner of procuring its prey, the common cat resembles all the other members of the same great family. It will watch for hours, with the utmost eagerness and assiduity, the peeping of a mouse from its hiding-place or the motions of a bird on the bough of a tree; and when the proper opportunity arrives, it pounces with one sudden spring on the unfortunate object. There is no sort of food that cats show a greater liking for than fish, and this has been matter of astonishment to many who are led to conceive that in a state of nature cats could not procure such food. It is a well-ascertained fact, however, that cats do actually take small fishes from shallow ponds and rivers. Many instances have been recorded of cats catching fish. "Mr Moody of Jesmond, near Newcastle, had a cat, in 1829, which had been in his possession for some years, that caught fish with great assiduity, and frequently brought them home alive. Besides minnows and eels, she occasionally carried home pilchards, one of which, about six inches long, was found in her possession in August 1827. She also contrived to teach a neighbour's cat to fish, and the two have been seen together watching by the Uis for fish. At other times they have been seen at opposite sides of the river, not far from each other, on the look-out for their prey." The following still more extraordinary circumstance of a cat fishing in the sea, appeared in the Plymouth Journal, June 1828:—"There is now at the battery, on the Devil's Point, a cat which is an expert catcher of the finny tribe, being in the constant habit of diving into the sea, and bringing up the fish alive in her mouth, and depositing them in the guard-room, for the use of the soldiers. She is now seven years old, and has long been a useful caterer. It is supposed that her pursuit of the water-rats first taught her to venture into the water, to which it is well known puss has a natural aversion. She is as fond of the water as a Newfoundland dog, and takes her regular peregrinations along the rocks at its edge, looking out for her prey, ready to dive for them at a moment's notice." We recollect a cat who spent the greater part of her time on the banks of a stream, living on small fish, which she caught there; but she also, in the first instance, seemed to be attracted by the water-rats, whom she used to pursue into the water.

In general, however, cats show a great disinclination to moisture, and take especial care to keep their feet dry. They are also extremely cleanly, and take much pains in brushing up their fur, especially about the face. Every one is aware that if a cat be taken into a dark place, and its back gently rubbed, vivid sparks of electricity will be elicited. These sparks will be stronger in proportion to the dryness of the air, and the fur of the animal. In fact, all animals, as well as every substance on the earth, possesses its portion of electric matter, and the reason of its being so visible in the case of the cat, is in consequence of the perfect dryness and soft silky nature of its fur. Cats, too, like many other animals, seem to be exceedingly sensitive to atmospheric changes: hence the cat has often been styled "the old woman's weather-glass." Cats, like all other animals of prey, sleep much during the day, and roam about at night. They prefer warm situations near the fire in winter, or basking opposite to the sun in summer. When highly pleased, the cat emits a sound well known by the term purring; this sound seems to be produced through the nostrils, and is probably the vibration of some membrane about the palate or lower part of the nostril; it is quite voluntary, and can be commanded at the pleasure of the animal. The hunting leopard purrs in the same manner; but we are unable to say whether this power of expressing satisfaction be common to others of the cat tribe.

The mew of the cat is by no means pleasing, and its nocturnal noises, and notes of love and war, are of the most harsh and grating description. Many persons have so singular an antipathy to cats, as to swoon away if one happens to be in the room with them. It is difficult to say whether this arises from any immediate odour of the animal, directly affecting the senses of such persons, or whether it be not merely the recollection of preconceived antipathies. Cats themselves seem to have some singular peculiarities of the sense of smelling. They have a dislike to many odours, while they are attracted by the scent of the common valerian root, with a pleasure almost amounting to fascination.—*Natural History of the Feline Species, by William Rhind, Esq.; forming vol. ii. of the Miscellany of Nat. Hist. edited by Sir Thomas Dick Lauder.*

[1] This description is principally taken from Mr Buffon: such parts as are added from others, I have marked with inverted commas.—*Note by Goldsmith.*

PLATE 39



J. Stewart Del. J. Miller Sc.

1 ASIATIC LION. 2. LIONESS. 3. BENGAL TIGER. 4. LEOPARD. 5. JAGUAR.

Blackie & Son. Glasgow. Edinburgh & London

all others the most terrible, the most undaunted. The wolf or the dog, instead of attempting to rival him, scarce deserve to attend his motions, or become his providers. Such, however, of these animals as are bred in a more temperate climate, or towards the tops of cold and lofty mountains, are far more gentle, or, to speak more properly, far less dangerous than those bred in the torrid valleys beneath. The lions of Mount Atlas, the tops of which are covered in eternal snows, have neither the strength nor the ferocity of the lions of Bildulgerid or Zaara, where the plains are covered with burning sands. It is particularly in these frightful deserts, that those enormous and terrible beasts are found, that seem to be the scourge and the terror of the neighbouring kingdoms. Happily indeed the species is not very numerous; and it seems to be diminishing daily: for those who have travelled through these countries, assure us, that there are by no means so many there at present, as were known formerly; and Mr Shaw observes that the Romans carried fifty times as many lions from Libya, in one year, to combat in their amphitheatres, as are to be found in the whole country at this time. The same remark is made with regard to Turkey, to Persia, and the Indies; where the lions are found to diminish in their numbers every day. Nor is it difficult to assign the cause of this diminution: it is obvious that it cannot be owing to the increase of the force of other quadrupeds, since they are all inferior to the lion, and consequently, instead of lessening the number, only tend to increase the supplies on which they subsist; it must therefore be occasioned by the increase of mankind, who is the only animal in nature capable of making head against these tyrants of the forest, and preventing their increase. The arms even of a Hottentot or a Negro make them more than a match for this powerful creature; and they seldom make the attack, without coming off victorious. Their usual manner is to find out his retreat, and, with spears headed with iron, to provoke him to the combat: four men are considered as sufficient for this encounter; and he against whom the lion flies, receives him upon his spear, while the others attack him behind: the lion, finding himself wounded in the rear, turns that way, and thus gives the man he first attacked an opportunity to recover. In this manner they attack him on all sides; until, at last, they entirely disable, and then despatch him. This superiority in the numbers, and the arts of man, that are sufficient to conquer the lion, serve also to enervate and discourage him; for he is brave only in proportion to the success of his former encounters. In the vast deserts of Zaara, in the burning sands that lie between Mauritania and Negroland, in the uninhabited countries that lie to the north of Catfraria, and, in general, in all the deserts of Africa, where man has not fixed his habitation, the lions are found in great numbers, and preserve their natural courage and force.[1]

---

[1] In modern times the lion is only known to exist, in his wild state, on the African continent, and more particularly in its interior, and throughout some of the hotter districts of Asia. The form and countenance of the animal are strikingly indicative of boldness, power. and dignity. The length of his body, measured from the tip of the nose to the root of the tail, varies from five to seven feet, and the average height is about four feet. The colour is a pale tawny, inclining to white beneath; and at the termination of the tail, which is nearly four feet long, there is a tuft of dark-coloured hair. The limbs of the animal are strong, and the hind legs in particular are extremely muscular, the spring of the lion depending on the haunches and thighs. The claws, with which their possessor can tear the limbs from a buffalo, exhibit a remarkable adaptation to their purpose. They are retractile, but not into sheaths, like those of most other beasts of prey; in the lion's paw, the retraction is performed by another mechanism. The bone of the last toe but one, by bending itself outwards, gives place to the last, which is only articulated to it; and to which the claw is fastened so as to bend itself upwards and sideways, more easily than downwards; so that the bone which is at the end of every toe being almost continually bent upwards, the point which rests upon the ground is not the extremity of the toe, but the node of the articulation of the last two bones; and thus, in walking, the claws remain elevated and retracted between the toes, those of the right paws towards the right, and those of the left towards the left, side of the toes. Without this admirable contrivance, the animal would be entangled in the soft earth at every tread.

The large, shaggy, pendant mane of the lion gives a dignified and thickset appearance to his head and shoulders. This ornament the lioness is deficient in: she is, besides, considerably smaller than the male. Her young, at birth, are like a pug-dog in size, and they do not leave their parent for nearly twelve months.

It is only in the interior of Africa, at the present day, that lions are to be found of the full size and strength which pertain to the race. The lions of India, and of Asia generally, are comparatively diminutive, though still powerful enough to vindicate the sovereignty of their breed. How prodigious the strength of the lion

Accustomed to measure their strength with every animal they meet, the habit of conquering renders them intrepid and terrible. Having never experienced the dangerous arts and combinations of man, they have no apprehensions from his power. They boldly face him, and seem to brave the force of his arms. Wounds rather serve to provoke their rage

---

is, may be conceived from the fact, that he finds no difficulty in dragging for a long way the heaviest ox, and carries a horse, heifer, hart, or other lesser prey, thrown over his shoulder, to any distance he may find convenient. "I have myself," says Mr Barrow, the well-known African traveller, "witnessed an instance of a very young lion conveying a horse a mile from the spot where he had killed it: and a more extraordinary case has been mentioned to me on good authority, where a lion, having carried off a heifer of two years old, was followed on the track for five hours, above thirty English miles, by a party on horseback; and throughout the whole distance, the carcass of the heifer was only once or twice discovered to have touched the ground." The strength of the animal is still more fully exhibited, perhaps, by the manner in which he kills his prey. To effect this, he seldom or never uses his teeth or claws; a stroke of his paw is in general sufficient, and one of his blows has been known frequently to break the back of a horse. It is true, that at his first onset the whole weight of his body assists in bringing the prey to the earth; the attack being always made by a spring from a considerable distance—such a distance, indeed, as is alone sufficient to indicate his great power. For this spring he lies couching and preparing, in the attitude best fitted to give force to the exertion. Even when the prey is on the ground, he still uses his paw, till his stroke is mortal.

The lion has from time immemorial been the chosen symbol of boldness, and, whether justly or not, the qualities of nobleness and generosity, that ever should accompany true courage, have also been almost universally assigned to the animal. A sleeping creature, it has been said, the lion will not injure; and for the extraction of a thorn from his festering paw, gratitude has made the animal, according to an old anecdote, become purveyor to his benefactor in the desert, and quell for his sake the fiercest cravings of hunger. Without giving an unqualified assent to such opinions as these, we are not bound, on the other hand, to adopt a belief of the very opposite kind, and to conclude, as Mr Barrow would have us, that the lion is treacherous and cowardly, braving danger only when rendered desperate by hunger, and shrinking timidly from it, when unstimulated by the cravings of appetite. The principal foundation for this opinion of Mr Barrow rests upon a circumstance, of which several instances have occurred, and one of which we shall now relate. An officer in India chanced one day to stroll into the jungle, in the neighbourhood of his quarters, and, before he had gone far, encountered a large lion face to face. Both parties came to a dead halt, and gazed earnestly at each other. The officer had no arms with him, save a sword, which in an assault from such an enemy as that before him, would be utterly useless. Giving himself up as lost, he had still presence of mind to recollect that lions and tigers sometimes gave way, it was said, to a firm gaze from man's eye. He therefore stood motionless, looking as steadily as possible upon the beast. The lion, which appeared ready to spring, after a minute or so grew disturbed, slunk aside, and attempted to creep round upon him. The officer steadily turned his face to the new quarter of attack, and the animal as regularly shrunk from his eye. This manœuvring continued nearly half an hour, when the lion at last slunk into the thicket and disappeared. The officer, it may be supposed, did not foresee any more pleasure in his stroll, and made the best of his way to his tent.

This inability to bear the gaze of the human eye has been put to the proof, involuntarily, it may well be supposed, on several occasions, and seems to be perfectly authenticated, both in the instance of tigers and lions. We have no doubt that the impression made on the animals arises simply from these two circumstances; firstly, that man is an erect being, and most unlike their usual prey; and, secondly, that a fixed stare is a confusing affair, to which these lords of the thicket are totally unaccustomed. Let the man conjoin his gaze with the movements well known to them, of resistance or flight, and the charm is fatally dissolved. This proves sufficiently, we think, that it is not cowardice, or fear of opposition, that deters them.

Probably we would not have taken the trouble to defend the tiger from the imputation of timidity, but such is the effect of old recollections, that to permit such a stain to rest on the lion is unendurable. To show that the lion possesses memory and gratitude, and, to use language usually applied to human beings, possesses a heart, the following anecdote may suffice. Mr John Hope, in a work entitled Thoughts in Prose and Verse (1782), thus writes:—"One day I had the honour of dining with the Duchess of Hamilton. After dinner, the company attended her grace to see a lion fed which she had in the court. While we were admiring his fierceness, and teazing him in his cage with sticks to make him fly at us, the porter came and informed the duchess that a serjeant with some recruits at the gate begged to see the lion. Her grace, with great condescension and good-nature, asked permission of the company to admit the travellers. They were accordingly admitted at the moment the lion was growling over his prey. The serjeant, advancing to the cage, called, 'Nero, Nero, poor Nero, don't you know me?' The animal instantly turned his head to look at him; then rose up, left his food, and ran, wagging his tail, to the side of the cage. The man put his hand upon him and patted him, telling us at the same time that it was three years since they had seen each other; and that the care of the lion, on his passage from Gibraltar, had been committed to him, and he was happy to see the poor beast show so much gratitude for his attention. The lion, indeed, seemed perfectly delighted; he went to and fro, rubbing himself against the place where the serjeant stood, and licking his benefactor's hand as he held it out to him. The man wanted to go into the cage to him, but was withheld by the company."

The feats of the lion in his wild state are by no means so pleasing to record, though, if we were inclined to be satirical, we might say that in his savage condition he approaches much more nearly to the ordinary notion of a *hero*. We may select a story or two from the many that are told of hair-breadth escapes from the fierce sovereign of the wilds. A writer in the South African Journal relates, that a Dutch settler at the Cape, Lucas Van Vuuren by name, while riding one day across the open plains, saw a lion at some distance. Lucas made a circuit to avoid him, but soon perceived that the lion had a mind to have some converse with him, before permitting him to pass. The Dutchman had no arms, and his horse was jaded, yet, on approaching a favourable spot, he set spurs to its sides, and galloped off as the only chance for life. All the Dutch are stout gentlemen, which was greatly to the rider's disadvantage in the present instance. The lion, nimble and furious with hunger, speedily overtook the fugitives, and at one bound on the horse's back, behind Lucas, brought the whole to the ground. The Dutchman, happily, was unhurt, and crawled from the spot, leaving the than repress their ardour. They are not daunted even with the opposition of numbers; a single lion of the desert often attacks an entire caravan; and, after an obstinate combat, when he finds himself overpowered, instead of flying, he continues to combat, re treating and still facing the enemy, till he dies. On the contrary, the lions which inhabit the peopled countries of Morocco or India, having become acquainted with human power, and experienced man's superiority, have lost all their courage so as to be scared away with a shout; and seldom attack any but the unresisting flocks or herds, which even women and children are sufficient to protect.

This alteration in the lion's disposition sufficiently shows that he might easily be tamed, and admit of a certain degree of education. "In fact, nothing is more common than for the keepers of wild beasts to play with this animal, to pull out his tongue, and even to chastise him without a cause. He seems to bear it all with the utmost composure; and we very rarely have instances of his revenging these unprovoked sallies of impertinent cruelty. However, when his anger is at last excited, the consequences are terrible Labet tells us of a gentleman who kept a lion in his chamber, and employed a servant to attend it; who, as is usual, mixed his blows with caresses. This ill judged association continued for some time; till one morning the gentleman was awakened by a noise in his room, which at first he could not tell the cause of; but drawing the curtains, he perceived a horrid spectacle; the lion growling over the man's head, which he had separated from the body, and tossing it round the floor. He immediately, therefore, flew into the next room, calling to the people without, and had the animal secured from doing farther mischief." However, this single account is not sufficient to weigh against the many instances we every day see of this creature's gentleness and submission. He is often bred up with other domestic animals, and is seen to play innocently and familiarly among them; and, if ever it happens that his natural ferocity returns, it is seldom exerted against his benefactors. As his passions are strong, and his appetites vehement, one ought not to presume that the impressions of education will always prevail; so that it would be dangerous in such circumstances to suffer him to remain too long without food, or to persist in irritating and abus-

---

lion so intent on worrying the horse as not to notice the doings of Lucas, who made off with all speed to the nearest habitation. To the fierceness of the lion's appetite the man owed his life. On returning to the spot next day, a few clean-picked bones were all that remained to substantiate the Dutchman's story, who, in telling it afterwards, used always to lament the loss of his saddle, and to consider its abstraction as the worst point in the lion's conduct, "seeing (as Lucas gravely observed) it was a thing for which he could have no possible use."

Dr Sparrman relates a story of a Hottentot, who being one evening far from home in the open plains, saw, to his great uneasiness, a lion at some distance watching apparently his motions. The man looked round anxiously for a secure place to take refuge in for the night, but could see none. At length he bethought himself of an expedient to test the lion's intentions towards him without danger. He crept under the ledge of a precipice which chanced to be near him, and, though it was growing very dark, he could perceive that the lion had followed him closely, and was but a little way off. The Hottentot then stripped himself of his upper covering and his hat, and placing them on his stick, waved them gently backwards and forwards above the edge of the cliff. The expedient was successful. The lion, after coming within springing distance, lay for an instant, and then bounded on his imaginary prey. The Hottentot had the satisfaction of hearing his dying yell, as he was dashed in his fall from rock to rock below.

It is in Africa chiefly, and occasionally in Asia, as we have said, that lion-adventures like these take place in modern times. But in ancient times these scenes were enacted not so far from home. Southern Europe, and particularly Turkey in Europe, appears to have harboured lions in considerable numbers. Not to mention Homer and other Grecian poets, who make frequent allusions to the lion, early writers, whose veracity may be depended on, describe these animals as existing in their day near Greece. Herodotus says, that the mountains of Thessaly and Macedonia contained many of them, so many indeed that the camels of Xerxes, the Persian king, were destroyed by lions, who made a descent on the army of the Asiatic invader. At a period considerably later, Xenophon, in his treatise on hunting, says, that in his time lions were hunted and caught in Macedonia, and near the mountains Pindus and Olympus, as well as in other neighbouring places. From the fabulous legends, ascribing the destruction of lions to Hercules and other demi-gods and heroes, we may conceive that, in reality, the breed was extirpated by hunters and men who acquired celebrity from the task.

Thus, it appears quite certain that lions did at one time exist in Europe. Indeed, a writer who lived four hundred years after Christ, avers, that in his day they were still, though rarely, to be found. If they were not existent in a native state in Europe some centuries before and after the beginning of our era, certain it is that there were abundance of them brought to it from other regions. Sylla, the Roman dictator, in his triumphal games at Rome, had no fewer than a hundred males, and Pompey, on a like occasion, no fewer than three hundred and fifteen lions of both sexes, exhibited in fights for the gratification of the populace. This custom continued throughout the whole existence of the Roman power, and all the Asiatic and African princes, being tributaries of the great city transmitted presents of wild beasts from all quarters to gratify the ruling taste. After the erection of the Colosseum, which held sixty thousand spectators, the splendour of these wild-beast fights surpassed all conception.

Lions are, it is supposed, long-lived in their natural state, one in the Tower of London having reached the age of seventy. There have been several other examples of a similar longevity; and we may therefore conclude that Buffon rates the length of their existence much too low, when he limits it to twenty years.—*Chambers' Journal.*

ing him: however, numberless accounts assure us that his anger is noble, his courage magnanimous, and his disposition grateful. He has been often seen to despise contemptible enemies, and pardon their insults, when it was in his power to punish them. He has been seen to spare the lives of such as were thrown to be devoured by him, to live peaceably with them, to afford them a part of his subsistence, and sometimes to want food himself rather than deprive them of that life which his generosity had spared.

It may also be said that the lion is not cruel, since he is so only from necessity, and never kills more than he consumes. When satiated, he is perfectly gentle; while the tiger, the wolf, and all the inferior kinds, such as the fox, the pole-cat, and the ferret, kill without remorse, are fierce without cause, and, by their indiscriminate slaughter, seem rather to satisfy their malignity than their hunger.

The outward form of the lion seems to speak his internal generosity. His figure is striking, his look confident and bold, his gait proud, and his voice terrible. His stature is not overgrown, like that of the elephant or rhinoceros; nor is his shape clumsy, like that of the hippopotamos or the ox. It is compact, well proportioned, and sizeable; a perfect model of strength joined with agility. It is muscular and bold, neither charged with fat nor unnecessary flesh. It is sufficient but to see him in order to be assured of his superior force. His large head surrounded with a dreadful mane; all those muscles that appear under the skin swelling with the slightest exertions; and the great breadth of his paws, with the thickness of his limbs, plainly evince that no other animal in the forest is capable of opposing it. He has a very broad face, that, as some have imagined, resembles the human. It is surrounded with very long hair, which gives it a very majestic air. The top of the head, the temples, the cheeks, the under-jaw, the neck, the breast, the shoulder, the hinder part of the legs, and the belly, are furnished with it, while all the rest of the body is covered with very short hair, of a tawny colour. "The length of the hair in many parts, and the shortness of it in others, serves a good deal to disguise this animal's real figure. The breast, for instance, appears very broad, but in reality it is as narrow and contracted in proportion as that of the generality of dogs and horses. For the same reason, the tail seems to be of an equal thickness from one end to the other, on account of the inequality of the hair with which it is encompassed; it being shorter near the insertion, where the flesh and bones are large, and growing longer in proportion as its real thickness lessens toward the point, where it ends in a tuft. The hair about the neck and the breast is not different from that on the rest of the body, except in the length of it; nor is each hair pointed, as in most other animals, but of an equal thickness, from one end to the other. The neck is very strong, but not composed of one solid bone, as Aristotle has imagined; on the contrary, though very short and muscular, it has as many bones as the camel or the horse; for it is universal to all quadrupeds to have seven joints in the neck, and not one of them have either more or less. However, the muscles in the neck of the lion, that tie the bones together, are extremely strong, and have somewhat the appearance of bones; so that ancient authors, who have treated of this animal, have mistaken the whole for a single bone. The tongue is rough, and beset with prickles as hard as a cat's claws; these have the grain turned backwards; so that it is probable a lion, if it should attempt to lick a man's hand, as we are told it sometimes does, would tear off the skin. The eyes are always bright and fiery; nor even in death does this terrible look forsake them. In short, the structure of the paws, teeth, eyes, and tongue, are the same as in a cat; and also in the inward parts these two animals so nearly resemble each other, that the anatomist's chief distinction arises merely from the size."

The lion has, as was observed before, a large mane, which grows every year longer as the animal grows older: the lioness is without this ornament at every age. This mane is not coarse or rough as in a horse, but composed of the same hair with the rest of the body, lengthened and shining. The mane, as well as the rest of the body, is of a yellow colour; nor is there ever any difference to be found in the colour of one lion from that of another. What the ancients might have said concerning black lions, or white, or streaked like the tiger, is not confirmed by modern experience; so that these varieties have never been seen, or exist no longer.

It is usually supposed that the lion is not possessed of the sense of smelling in such perfection as most other animals. It is also observed, that too strong a light greatly incommodes him. This is more than probable from the formation of his eyes, which, like those of the cat, seem fitted for seeing best in the dark. For this reason he seldom appears in open day, but ravages chiefly by night; and not only the lion, but all other animals of the cat kind, are kept off by the fires which the inhabitants light to preserve their herds and flocks; the brightness of the flame dazzles their eyes which are only fitted for seeing in the dark; and they are afraid to venture blindly into those places which they know to be filled with their enemies. "It is equally true of all this kind, that they hunt rather by the sight than the smell: and it sometimes happens that the lion pursues either the jackal or the wild dog, while they are hunting upon the scent; and, when they have run the beast down, he comes in and monopolizes the spoil. From hence, probably, may have arisen the story of the lion's provider: these little industrious animals may often, it is true, provide a feast for the lion; but they have hunted merely for themselves, and he is an unwelcome intruder upon the fruits of their toil."

The lion, when hungry, boldly attacks all animals that come in his way; but as he is very formidable, and as they all seek to avoid him, he is often obliged to hide, in order to take them by surprise.[1] For this purpose he crouches on his belly in some thicket, or among the long grass, which is found in many parts of the forest; in this retreat he continues, with patient expectation, until his prey comes within a proper distance, and he then springs after it fifteen or twenty feet from him, and often seizes it at the first bound. If he misses the effort, and in two or three reiterated springs cannot seize his prey, he continues motionless for a time, seems to be very sensible of his disappointment, and waits for a more successful opportunity. In the deserts and forests his most usual prey are the gazelles and the monkeys, with which the torrid regions abound. The latter he takes when they happen to be upon the ground, for he cannot climb trees like the cat or the tiger. He devours a great deal at a time, and generally fills himself for two or three days to come. His teeth are so strong that he very easily breaks the bones, and swallows them with the rest of the body. It is reported that he sustains hunger a very long time, but thirst he cannot support in an equal degree, his temperament being extremely hot; some have even asserted that he is in a continual fever. He drinks as often as he meets with water, lapping it like a cat, which, as we know, drinks but slowly. He generally requires about fifteen pounds of raw flesh in a day; he prefers that of live animals, and particularly those which he has just killed. He seldom devours the bodies of animals when they begin to putrify, and he chooses rather to hunt for a fresh spoil, than to return to that which he had half devoured before. However, though he usually feeds upon fresh provision, his breath is very offensive, and his urine unsupportable.

The roaring of the lion is so loud, that when it is heard in the night and re-echoed by the mountains, it resembles distant thunder. This roar is his natural note; for when enraged he has a different growl, which is short, broken, and reiterated. The roar is a deep hollow growl, which he sends forth five or six times a-day, particularly before rains. The cry of anger is much louder and more formidable. This is always excited by opposition; and upon those occasions, when the lion summons up all his terrors for the combat, nothing can be more terrible. He then lashes his sides with his long tail, which alone is strong enough to lay a man level. He moves his mane in every direction; it seems to rise and stand like bristles round his head; the skin and muscles of his face are all in agitation; his huge eyebrows half cover his glaring eye-balls; he discovers his teeth, which are formed rather for destruction than chewing his food; he shows his tongue covered with points, and extends his claws, which appear almost as long as a man's fingers. Prepared in this manner for war, there are few animals that will venture to engage him; and even the boldest of the human kind are daunted at his approach. The elephant, the rhinoceros, the tiger, and the hippopotamos, are the only animals that are not afraid singly to make opposition.

"Nevertheless, neither the leopard nor the wild boar, if provoked, will shun the combat: they do not seek the lion to attack, but will not fly at his approach; they wait his onset, which he seldom makes unless compelled by hunger; they then exert all their strength, and are sometimes successful. We are told of the combat of a lion and a wild boar, in a meadow near Algiers, which continued for a long time with incredible obstinacy. At last, both were seen to fall by the wounds they had given each other; and the ground all about them was covered with their blood. These instances, however, are very rare, for the lion is in general the undisputed master of the forest. Man is the only creature that attacks him with almost certain success; with the assistance of dogs and horses which are trained to the pursuit.[1] These animals, that, in a state of nature, would have fled from the presence of the lion in an agony of consternation, when conscious of the assistance of man, become pursuers in their turn, and boldly hunt their natural tyrant. The dogs are always of

---

[1] *Lion Hunting.*—Ten or twelve colonists, mounted and armed with their large guns, go out, and having, with the assistance of their dogs and Hottentots, ascertained where the spoiler lies, approach within a moderate distance, and then alighting, make fast the horses to each other by their bridles and halters. They then advance to within about thirty paces, backing the horses before them, knowing to within what distance, and being aware, from his aspect and motions, whether he is likely to anticipate their attack. As they advance, the lion at first surveys them calmly, and wags his tail as in a pleased or playful humour; but when they approach nearer, he begins to growl, and draws his hind parts under his breast till almost nothing of him is seen, except his bushy, bristling mane, and his eyes of living fire gleaming fiercely from the midst of it. He is now fully enraged, and only measuring his distance in act to spring upon his audacious assailants. This is the critical moment, and the signal for half the party to fire. If they are not successful in killing him at the first volley, he springs like a thunderbolt upon the horses. The rest of the party then pour in their fire upon him, which seldom fails to finish his career, though, perhaps, with the loss of one or more horses; and sometimes, though more rarely, some even of the huntsmen are destroyed in these dangerous encounters.—*Thomson's Travels in Africa.*

---

[1] The late amiable Mr Pringle, who in 1822 was a settler on the eastern frontier of the Cape colony, in Southern Africa, has given some excellent descriptions of rencounters with lions. In our journey from Algoa Bay (he says) to our location of Glen-Lynden, or Baviaan's River, we had occasionally seen in the distance herds of large game, chiefly of the antelope tribe; and we found our highland valley to be pretty well stocked with quaggas, hartebeests, reeboks, rietboks, oribis, klipspringers, wild hogs, and a variety of smaller animals. But we had as yet seen none of the beasts of prey that inhabit the country, with the exception of one or two jackals, although we had once heard the *gurr* of the Cape tiger (or leopard), and been serenaded nightly by the hungry howl of the hyæna, almost all the way from the coast. We were not allowed, however, to continue long without a closer acquaintance with our neighbours of the carnivorous class. The lion introduced himself, in a mode becoming his rank and character, a few nights after our arrival at Glen-Lynden.

The serene weather with which we had been favoured during our journey, was succeeded on the third of July (the day after our first sabbath meeting) by a cold and wet evening. The night was extremely dark, and the rain fell so heavily that, in spite of the abundant supply of dry firewood which we had luckily provided, it was not without difficulty that we could keep one large watch-fire burning. Having appointed our watch for the night (a service which all the male adults, masters as well as servants, agreed to undertake in rotation), we had retired to rest, and, excepting our sentinel, were all buried in sleep, when about midnight we were suddenly roused by the roar of a lion close to our tents. It was so loud and tremendous that for a moment I actually thought that a thunder cloud had broken close beside us. But the peculiar *expression* of the sound—the voice of fury as well as of power—instantly undeceived me; and instinctively snatching my loaded gun from the tent pole, I hurried out—fancying that the savage beast was about to break into our camp. Most of our men had sprung to their arms, and were hastening to the watch-fire, with a similar apprehension. But all around was complete darkness; and scarcely two of us were agreed as to the quarter whence the voice had issued. This uncertainty was occasioned partly, perhaps, by the peculiar mode this animal often has of placing his mouth near the ground when he roars, so that the voice rolls, as it were, like a breaker along the earth; partly, also, to the echo from a rock which rose abruptly on the opposite bank of the river; and, more than all, to the confusion of our senses in being thus hurriedly and fearfully aroused from our slumbers. Had any one retained self-possession sufficient to have quietly noted our looks on this occasion, I suspect he would have seen a laughable array of pale or startled visages. The reader who has only heard the roar of the lion at the Zoological Gardens, can have but a faint conception of the same animal's voice in his state of freedom and uncontrolled power. Novelty in our case gave it double effect, on our thus hearing it for the first time in the heart of the wilderness. Having fired several volleys in all directions round our encampment, we roused up the half-extinguished fire to a blaze, and then flung the flaming brands among the surrounding trees and bushes. And this unwonted display probably daunted our grim visitor, for he gave us no further disturbance that night.

A few days afterwards some of our people had a day-light interview with a lion—probably the same individual who had given us this boisterous greeting. They had gone a mile or two up the valley to cut reeds for thatching the temporary huts which we proposed to erect by the combined labour of the party, and were busy with their sickles in the bed of the river, when, to their dismay, a huge lion rose up among the reeds, almost close beside them. He leaped upon the bank, and then turned round and gazed steadfastly at them. One or two men who had guns, seized them hastily and began to load with ball. The rest, unarmed and helpless, stood petrified; and had the lion been so disposed he might easily have made sad havock among them. He was, however, very civil—or, to speak more correctly, he was probably as much surprised as they were. After quietly gazing for a minute or two at the intruders on his wild domain, he turned about and retired, first slowly, and then, after he was some distance off, at a good round trot. They prudently did not attempt to interfere with his retreat.

After this, when we had moved our encampment farther up the valley, and had exchanged our tents for temporary reed-covered cabins, we were visited, during the winter and ensuing spring, several times by lions, but without our ever coming into actual conflict with them. On one of those occasions a lion and lioness had very nearly carried off, in a dark night, some of our horses, but were scared by a firebrand when within a few yards of their prey. It is worthy of remark, that the lion always prefers a horse to an ox when he has the choice. After we had got some Hottentots beside us, we rode out, after some of those alarms, to hunt these formidable visitors, but without being able to discover their coverts.

The first actual rencontre occurred while I was absent from the settlement, on a visit to our district magistrate. The following were the circumstances, as detailed to me by the parties present. A horse was missing, belonging to Mr George Rennie, a young farmer of our party (descended from the same family in East Lothian as the celebrated engineer of that name;) and, after some search, it was discovered by the foot-prints to have been killed by a lion. The boldest men of the settlement having assembled to give battle to the spoiler, he was traced without difficulty by the Hottentots to a secluded spot, about a mile or upwards from the place where he had seized his prey. He had carried it with him to devour it at his leisure, as is the usual practice of this powerful animal. On the approach of the hunters, the lion after some little demur, retreated to a small thicket in a shallow ravine at no great distance. The huntsmen followed cautiously, and having taken post on a height adjoining the ravine, poured volley after volley into the thicket. This bombardment produced no perceptible effect; the lion kept under covert and refused to give battle; only when the wolf-hounds were sent in to tease him, he drove them forth again with a savage growl, and a bloody scratch or two from his claws. At length, Mr Rennie, the leader of the hunt, and a man of daring hardihood, losing patience at this fruitless proceeding, descended from the height, and approaching the thicket, threw several large stones into the midst of it. This rash bravado brought forth the lion. He sprung fiercely from his covert, and with another bound or two would probably have had our friend prostrate under his paw, but most fortunately at this critical moment, the attention of the savage beast was attracted by a favourite dog of Mr Rennie's, which ran boldly up to the lion and barked in his face. The poor dog was destroyed in a moment: a single blow from the lion's paw rewarded his generous devotion with death. But that instant was sufficient to save his master. Mr Rennie had instinctively sprung back a pace or two, and his comrades on the

the large breed; and the horses themselves, as Gessner assures us, must be of that sort called *charossi*, or lion-eyed, all others of this kind flying at the sight of the lion, and endeavouring to throw their riders. When the lion is roused, he recedes with a slow proud motion; he never goes off directly forward, nor measures his paces equally, but takes an oblique course, going from one side to the other, and bounding rather than running. When the hunters approach him, they either shoot or throw their javelins; and in this manner disable him before he is attacked by the dogs, many of whom he would otherwise destroy. He is very vivacious, and is never killed at once, but continues to fight desperately, even after he has received his mortal blow. He is also taken by pit-falls; the natives digging a deep hole in the ground, and covering it slightly over with sticks and earth, which, however, give way beneath his weight, and he sinks to the bottom, from whence he has no means of escape. But the most usual manner of taking this animal is while a cub, and incapable of resistance. The place near the den of the lioness is generally well known by the greatness of her depredations on that occasion; the natives therefore watch the time of her absence; and aided by a swift horse, carry off her cubs; which they sell to strangers or to the great men of their country."

The lion, while young and active, lives by hunting in the forest, at the greatest distance from any human habitation; and seldom quits this retreat while able to subsist by his natural industry; but when he becomes old and unfit for the purposes of surprise, he boldly comes down into places more frequented, attacks the flocks and herds that take shelter near the habitation of the shepherd or the husbandman, and depends rather upon his courage than his address for support. It is remarkable, however, that when he makes one of these desperate sallies, if he finds men and quadrupeds in the same field, he only attacks the latter, and never meddles with men, unless they provoke

---

rock fired at once with effect. The lion fell dead upon the spot, several balls having passed through his body.

The next serious rencounter that we had with the monarch of the wilderness occurred a considerable time afterwards, when the several families of our party had taken possession of their separate allotments, and our temporary encampment was broken up. I happened then to be residing with my family, and a few Hottentot servants, at a place to which, from the picturesque forms of the adjacent mountains, we had given the Scottish name of Eildon. My next neighbour, at that time, was Captain Cameron, a Scotch officer, who had lately come to occupy the farm immediately below me on the river. I had gone one evening down with another gentleman and two or three female relatives to drink tea with Captain Cameron's family. The distance being scarcely four miles, we considered ourselves, in that thinly peopled country, next-door neighbours; and, as the weather was fine, we agreed to ride home by moonlight—no lions having been seen or traced in the valley for nearly twelve months. We returned accordingly, jesting as we rode along about wild beasts and Caffers. That part of the valley we were passing through is very wild, and encumbered in several places with jungles and thickets of evergreens; but we had no suspicion at the moment of what afterwards appeared to be the fact—that a lion was actually dogging us through the bushes the whole way home. Happily for us, however, he did not then show himself, nor give us any indication of his presence; being probably somewhat scared by our number, and the white dresses of the ladies glancing in the moonlight.

About midnight, however, I was awakened by an unusual noise in my *kraal*, or cattle-fold, close behind my cabin. Looking out I saw the whole of the horned cattle springing wildly over the high thorn fence, and scampering round my hut. Fancying that a hyæna, which I had heard howling when I went to bed, had alarmed the animals by breaking into the kraal, I seized my gun, and sallied forth in my shirt to have a shot at it. Though the cloudless full moon shone with a brilliant light (so bright in that fine climate that I have frequently read print by it,) I could discover no cause for the terror of the cattle, and after calling a Hottentot to shut them again into the kraal, I retired once more to rest. Next morning, Captain Cameron rode up to inform me that herdsmen had discovered by the traces in the path, that a large lion had followed us up the valley the preceding night; and, upon further search, it was ascertained that this unwelcome visitant had actually been in the kraal the preceding night, and had carried off a couple of sheep. But as he appeared by the traces (which our Hottentots followed with wonderful dexterity) to have retreated with his prey to the mountains, we abandoned for the moment all idea of pursuing him.

The lion was not disposed, however, to have done with us on such easy terms. He returned that very night, and killed my favourite riding-horse, little more than a hundred yards from the door of my cabin. I then considered it full time to take prompt measures in self-defence; and sent a messenger round the location to call out the neighbours to hunt him, being assured by my Hottentots that, as he had only devoured a small portion of the horse, he would certainly be lurking in the immediate vicinity. The huntsmen speedily assembled, and, with the aid of the Hottentots, we soon discovered the lion in covert, about a mile from the spot. The scene that followed resembled very closely, in many particulars, the adventure of Mr George Rennie on the occasion already described. The lion, on this occasion also, refused to leave the covert. Mr Rennie and his brother John, and another Scotsman, with three mulatto Hottentots, went into the jungle to attack him. He then sprung out in a fury, and gave battle to the assailants—struck down John Rennie, and placed his foot upon him, and looked round upon us most majestically for a few seconds, as if considering whether he should tear a few of us to pieces or not. Seeing us a numerous band (there were seventeen of us) he seemed to judge we were too many for him; and so leaving our fallen friend with no further injury than the marks of his five claws about half an inch into his flesh, he bounded from the thicket, and retreated up Glen-Douglas towards the Caffer mountains. We pursued him hotly up the glen, and our wolf-hounds held him at bay under a mimosa tree till we intercepted his path, seized the heights around, and shot him dead, without again venturing within reach of his claws. He was a fine full grown lion of the yellow variety; and, in memorial of our African exploits, the skin and skull were sent as a small token of kindness and respect to Sir Walter Scott, and now form part of the ornaments of the lamented poet's armoury at Abbotsford.

him to engage. It is observed that he prefers the flesh of camels to any other food: he is likewise said to be fond of that of young elephants; these he often attacks before their trunk is yet grown; and, unless the old elephant comes to their assistance, he makes them an easy prey.

The lion is terrible upon all occasions, but particularly at those seasons when he is incited by desire, or when the female has brought forth. It is then that the lioness is seen followed by eight or ten males, who fight most bloody battles among each other, till one of them becomes victorious over all the rest. She is said to bring forth in spring, and to produce but once a year. "With respect to the time of gestation, naturalists have been divided, some asserting that the lioness went with young six months, and others but two. The time also of their growth and their age have hitherto been left in obscurity: some asserting that they acquired their full growth in three years, and others that they require a longer period to come to perfection; some saying (and among this number is Mr Buffon) that they lived to but twenty or twenty-two years at most; others making their lives even of shorter duration. All these doubts are now reduced to certainty; for we have had several of these animals bred in the Tower; so that the manner of their copulation, the time of their gestation, the number they bring forth, and the time they take to come to perfection, are all pretty well known. Although the lion emits his urine backwards, yet he couples in the ordinary manner, and, as was said before, his internal structure, in almost every respect resembles that of a cat. The lioness, however, is upon these occasions particularly fierce, and often wounds the lion in a terrible manner. She goes with young, as I am assured by her keeper, no more than five months: the young ones, which are never more than two in number when brought forth, are about the size of a large pug-dog, harmless, pretty, and playful; they continue the teat for twelve months, and the animal is more than five years in coming to perfection. As to its age, from its imprisoned state, we can have no certainty; since it is very probable, that being deprived of its natural climate, food, and exercise, its life must be very much abridged. However, naturalists have hitherto been greatly mistaken as to the length of its existence. The great he-lion called *Pompey*, which died in the year 1760, was known to have been in the tower for above seventy years; and one lately died there, which was brought from the river Gambia, that died above sixty-three. The lion, therefore, is a very long-lived animal: and very probably, in his native forests, his age exceeds even that of man himself."

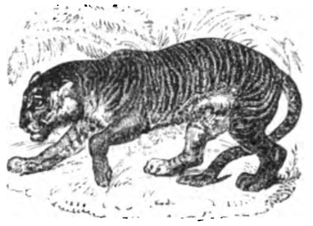
In this animal all the passions, even of the most gentle kind, are in excess, but particularly the attachment of the female to her young. The lioness, though naturally less strong, less courageous, and less mischievous than the lion, becomes terrible when she has got young ones to provide for. She then makes her incursions with even more intrepidity than the lion himself; she throws herself indiscriminately among men and other animals; destroys without distinction; loads herself with the spoils, and brings it home reeking to her cubs, whom she accustoms betimes to cruelty and slaughter. She usually brings forth in the most retired and inaccessible places; and when she fears to have her retreat discovered, often hides her tracks by running back her ground, or by brushing them out with her tail. She sometimes also, when her apprehensions are great, transports them from one place to another; and, if obstructed, defends them with determined courage, and fights to the last.

The lion is chiefly an inhabitant of the torrid zone; and as was said, is always most formidable there; nevertheless, he can subsist in more temperate climates; and there was a time when even the southern parts of Europe were infested by him. At present, he is only found in Africa and the East Indies; in some of which countries he grows to an enormous height. The lion of Bildulgerid is said to be nearly five feet high, and between nine and ten feet from the tip of the nose to the insertion of the tail. We have in the tower, at present, one of above four feet high, that was brought from Morocco, which is the largest that for some time past has been seen in Europe. The ordinary size is between three and four feet; the female being, in all her dimensions, about one-third less than the male. There are no lions in America; the Puma, which has received the name of the *American lion*, is, when compared, a very contemptible animal, having neither the shape, the size, nor the mane of the lion; being known to be extremely cowardly, to climb trees for its prey, to subsist rather by its cunning than its courage, and to be inferior even to the animal that goes by the name of the American tiger. We ought not, therefore, to confound this little treacherous creature with the lion, which all the ancients have concurred in denominating the *king of beasts*, and which they have described as brave and merciful. "Indeed, the numerous accounts which they have given us of this animal's generosity and tenderness, show that there must be some foundation for the general belief of its good qualities; for mankind seldom err when they are all found to unite in the same story. However, perhaps the caution of Aristophanes the comic poet, is better followed in practice, who advises us to have nothing to do with this creature, but to let the lioness suckle her own whelps."[1]

THE TIGER.

"The ancients had a saying, *That as the peacock is the most beautiful among birds, so is the tiger among quadrupeds.*[2] In fact, no quadruped can be more beautiful than this animal: the glossy smoothness of his hair, which lies much smoother, and shines with greater brightness, than even that of the leopard, the extreme blackness of the streaks with which he is marked, and the bright yellow colour of the ground which they diversify, at once strike the beholder. To this beauty of colouring is added an extremely elegant form, much larger indeed than that of the leopard, but more slender, more delicate, and bespeaking the most extreme swiftness and agility. Unhappily, however, this animal's disposition is as mischievous as its form is admirable; as if Providence was willing to show the small value of beauty, by bestowing it on the most noxious of quadrupeds. We have at present one of these animals in the Tower, which, to the view, appears the most good-natured and harmless creature in the world; its physiognomy is far from fierce or angry; it has not the commanding stern countenance of the lion, but a gentle placid air; yet for all this, it is fierce and savage beyond measure; neither correction can terrify, nor indulgence can tame it."

The chief and most observable distinction in the tiger, and in which it differs from all others of the mottled kind, is in the shape of its colours, which run in streaks or bands in the same direction as his ribs, from the back down to the belly. The leopard, the panther, and the ounce, are all partly covered like this animal, but with this difference, that their colours are broken in spots all over the body; whereas, in the tiger they stretch lengthwise, and there is scarce a round spot to be found on his skin. Besides this, there are other observable distinctions: the tiger is much larger, and often found bigger even than the lion himself; it is much slenderer also in proportion to its size, its legs shorter, and its neck and body longer. In short, of all other animals, it most resembles the cat in shape; and if we conceive the latter magnified to a very great degree, we shall have a tolerable idea of the former.



In classing carnivorous animals, we may place the lion foremost;[3] and immediately after him follows the tiger, which seems to partake of all the noxious qualities of the lion, without sharing any of his good ones. To pride, courage, and strength, the lion joins greatness, clemency, and generosity; but the tiger is fierce without provocation, and cruel without necessity. The lion seldom ravages except when excited by hunger; the tiger, on the contrary, though glutted with slaughter, is not satisfied, still continues the carnage, and seems to have its courage only inflamed by not finding resistance. In falling in among a flock or herd, it gives no quarter, but levels all with indiscriminate cruelty, and scarcely finds time to appease its appetite, while intent upon satisfying the malignity of its nature. It thus becomes the scourge of the country where it is found; it fears neither the threats nor the opposition of mankind; the beasts, both wild and tame, fall equally a sacrifice to its insatiable fury; the young elephant and the rhinoceros become equally its prey, and it not unfrequently ventures to attack even the lion himself.

Happily for the rest of nature, that this animal is not common, and that the species is chiefly confined to the warmest provinces of the East. The tiger is found in Malabar, in Siam, in Bengal, and in all the countries which are inhabited by the elephant or the rhinoceros.[4] Some even pretend that it has

---

[1] Οὐ χρὴ λέοντος σκύμνον ἐν πόλει τρέφειν.

[2] Tantum autem præstat pulchritudine tigris inter alias færas quantum inter volucres pavo.

[3] The remainder of this description is taken from Mr Buffon, except where marked with commas.--*Note by Goldsmith.*

[4] The tiger is exclusively confined to the Asiatic continent, and though its range from north to south is very extensive, that in the opposite directions is rather circumscribed. It is found in the desert countries which separate China from Siberia, and as far as the banks of the Obi; and in the greater number of the larger East Indian islands, such as Java and Sumatra. The peninsula of Malacca is also said to abound with them; but the great nursing places of the tiger, their cradle, as Temminck terms it, is the peninsula of Hindostan; the vast jungles of this rich country lining the courses of her majestic rivers, harbour thousands of these animals, for water is almost as indispensible for their nourishment as food. The larger islands are therefore also favourite resorts, and many lives have been sacrificed in attempting to free this district from these powerful pests. Cozimbar and Saugur islands are well known in the annals of tiger destruction, and many has been the fatal encounter on their luxuriant shores.

The tiger was much less familiarly known to the ancients, than either the lion or the spotted African cats. Among the Greeks it was scarcely known at all, Aristotle merely mentioning it as an animal he had heard of a friendship for, and often accompanies the latter, in order to devour its excrements, which serve it as a purge. Be this as it will, there is no doubt but that they are often seen together at the sides of lakes and rivers: where they are probably both compelled to go by the thirst which, in that torrid climate, they must very often endure. It is likely enough also that

---

Pliny tells us that the first tiger known among the Romans, was a tame one belonging to Augustus. Claudius, however, afterwards exhibited four at a time; and it has been conjectured that the beautiful Mosaic picture of four tigers, discovered some years ago in Rome, near the arch of Gallicius, was executed at that period in commemoration of so striking and unprecedented a display.

The tiger, in a country where he can be well supplied with food, is a nocturnal animal, lying during the day in some thick cover defended from the scorching heat, and gorged with his last meal in sleepy indolence. In such uncultivated districts he watches at dawn and even by the side of some track, where the various animals pass, or about the edges of the jungle, and above all at the springs and drinking-places of the rivers, which in the impenetrable thickets have but one common access to friend or foe. Hither animals, both weak and powerful crowd, forced by the scorching heats to seek coolness and drink, and here the tiger is seldom baffled of his prey.

> "Here couched the panting tiger, on the watch;
> Impatient but unmoved, his fireball eyes
> Made horrid twilight in the sunless jungle,
> Till on the heedless buffalo he sprang,
> Dragged the low-bellowing monster to his lair—
> Crashed through his ribs at once into his heart—
> Quaffed the hot blood, and gorged the quivering flesh,
> Till drunk he lay, as powerless as the carcass."

Where civilization has commenced, the tiger has learned to prowl around the villages, and attack the cattle-folds, to seize indiscriminately whatever comes in his way. Travelling parties are followed, and a luckless straggler seldom escapes; the baggage-trains, consisting of troops of oxen and buffaloes trained to the yoke, are closely watched, and though attended during the day with drums and noisy instruments, and during night with torches, a journey is seldom performed without some accident or attack.

In the New Indian settlements, the ravages committed by the tigers were such, that active means were necessary for their destruction, and a price of ten rupees was put upon the head of each. Various methods were employed by the natives to destroy this animal, which could only be partially successful; but the improved use of the rifle has rendered the more thickly inhabited parts comparatively safe from them. Among the inventions formerly in use, and still practised in many parts, the most successful was that of shooting them with a poisoned arrow, from a bow, placed so as to be disengaged by the animal passing. The bow is made of split bamboo, from six to eight feet in length, and at the middle from nine to ten inches in girth. The string is of strong catgut, and often half an inch in circumference. The bow is fixed with great nicety at the middle by two stakes, distant enough to allow the arrow to pass freely without touching, and placed at a distance from the ground, in proportion to the size of the animal to be killed. The string is drawn back and fastened by a wedge, to which a cord is attached, and strained moderately tight to a stake on the opposite side of the path, to be traversed by the animal. The tiger generally falls within 200 yards of the fatal shot, being frequently struck through the lungs, and often through the heart, and the poison, if less mortally wounded, seldom fails to kill within the hour.

A heavy beam is also sometimes suspended over the path, to which a cord is attached, which is in like manner disengaged, and the animal is crushed below the weight of the wood. Another method said to be common in Persia, is mentioned in the Oriental Field Sports. "This device consists of a large spherical cage, made of strong bamboos, or other efficient materials, woven together, but leaving intervals throughout, of about three or four inches broad. Under this cover, which is fastened to the ground by means of pickets, in some place where tigers abound, a man provided with two or three short strong spears, takes post at night. Being accompanied by a dog, which gives the alarm, or by a goat, which, by its agitation, answers the same purpose, the adventurer wraps himself up in his quilt, and very composedly goes to sleep, in full confidence of his safety. When a tiger comes, and, perhaps after smelling all around, begins to rear against the cage, the man stabs him with one of the spears through the interstices of the wicker-work, and rarely fails of destroying the tiger, which is ordinarily found dead at no great distance in the morning."

Another, rather of a more ludicrous character, is related by the same entertaining writer, as successfully practised in the dominions of Oude. "The track of a tiger being ascertained, which, though not invariably the same, may yet be known sufficiently for the purpose, the peasants collect a quantity of the leaves of the prous, which are like those of the sycamore, and are common in most underwoods, as they form the largest portion of most jungles in the north of India. These leaves are smeared with a species of bird-lime, made by bruising the berries of an indigenous tree, by no means scarce. They are then strewed with the gluten uppermost, near to that opaque spot to which it is understood the tiger usually resorts during the noon-tide heat. If by chance the animal should tread on one of the smeared leaves, his fate may be considered as decided. He commences by shaking his paw, with the view to remove the adhesive incumbrance, but finding no relief from that expedient, he rubs the nuisance against his jaw, with the same intention, by which means his eyes, ears, &c. become agglutinated, and occasion such uneasiness, as causes him to roll, perhaps among many more of the smeared leaves, till at length he becomes completely enveloped, and is deprived of sight, and in this situation he may be compared to a man who has been tarred and feathered. The anxiety produced by this strange and novel predicament, soon discovers itself in dreadful howlings, which serve to call the watchful peasants, who in this state find no difficulty in shooting the object of their detestation."

In addition to these we shall only mention another device said to be at this day practised among the Chinese: and singular, as corresponding with the sculptured representation of the ancients. It is taking them in a box-trap, to which the animal is attracted by a looking-glass, placed in the inside, and when attacking its own image, it disengages the fastening of the lid of the box. This very subject is represented by Montfaucon, as carved upon one of the sides of the tomb of the Nasus, and I believe the ancient origin of it is also confirmed by Claudian.

Since India became so much the country of Europeans, the race of tigers has been much thinned, and ere long it is probable that they will be driven to the most remote and impenetrable districts. Hunting the tiger is a sport exclusively Indian; and it suits well to the ardour and spirit of British sportsmen: it is looked upon as far pre-eminent over the other sports of India, as that of the fox in Britain is held superior to a chase with rabthey seldom make war upon each other, the rhinoceros being a peaceable animal, and the tiger knowing its strength too well to venture the engagement. It is still more likely that the tiger finds this a very convenient situation, since it can there surprise a greater number of animals, which are compelled thither from the same motives. In fact it is generally known

---

bit beagles. It is pursued with great parade and show, a large retinue of followers, and almost royal splendour; and in addition, it possesses the excitement of being attended with considerable danger.

The only animal found suitable to assist in the capture of this formidable beast, is the elephant, which often displays great courage and coolness in the chase, and at times a sagacity which has saved the rider's life. When notice has been got that there is a tiger in the neighbourhood, the whole station is roused, and preparation to proceed to the cover is commenced; the elephants are prepared, and the tumult which commences before all is ready, between mahouts and syces, dogs and horses, elephants and their masters, can be compared to nothing in this country, where, in well regulated hunting establishments, rule and regularity prevail. From ten to thirty of these animals, each carrying a sportsman armed with rifles of various descriptions, generally start for the jungle, though sometimes a field of nearly 100 elephants have been out, and being arranged in line, commence regularly to beat for the game; but having thus brought them to the jungle's edge, we shall allow one more experienced than ourselves to describe the hunt.

"We found (says Captain Munday), immense quantities of game, wild hogs, hog-deer, and the Neil-ghie, (literally blue-cow.) We, however, strictly abstained from firing, reserving our whole battery for the nobler game, the tiger. It was perhaps fortunate that we did not find one in the thick part of the forest, as the trees were so close set, and so interwoven with thorns and parasite plants, that the elephants were often obliged to clear for themselves a passage by their own pressing exertions. It is curious on these occasions to see the enormous trees these animals will overthrow on a word from the mahout, they place their foreheads against the obnoxious plants, twisting their trunks round it, and gradually bending it towards the ground, until they can place a foot upon it. This done, down comes the tree with crashing stem and upturned roots. The elephant must be well educated to accomplish this duty in a gentlemanlike manner: that is, without roaring sulkily, or shaking his master by too violent exertions. On clearing the wood, we entered an open space of marshy grass, not three feet high; a large herd of cattle were feeding there, and the herdsman was sitting singing under a bush; when, just as the former began to move before us, up sprang the very tiger to whom our visit was intended, and cantered off across a bare plain, dotted with small patches of bush-jungle. He took to the open country in a style which would have more become a fox than a tiger, who is expected by his pursuers to fight and not to run; and as he was flushed on the flank of the line, only one bullet was fired at him ere he cleared the thick grass. He was unhurt, and we pursued him at full speed. Twice he threw us out by stopping short in small stripes of jungle, and then heading back after we had passed: and he had given us a very fast trot of about two miles, when colonel Arnold, who led the field, at last reached him by a capital shot, his elephant being in full career. As soon as he felt himself wounded, the tiger crept into a close thicket of trees and bushes, and crouched. The two leading sportsmen overran the spot where he lay; and as I came up, I saw him, through an aperture, rising to attempt a charge. My mahout had just before, in the heat of the chase, dropped his ankors or goad, which I had refused to allow him to recover; and the elephant, being notoriously savage, and farther irritated by the goading he had undergone, became consequently unmanageable; he appeared to see the tiger as soon as myself, and I had only time to fire one shot, when he suddenly rushed with the greatest fury into the thicket, and falling upon his knees, nailed the tiger with his tusks to the ground. Such was the violence of the shock, that my servent, who sat behind, was thrown out and one of my guns went overboard. The struggles of my elephant to crush his still resisting foe, who had fixed one paw on his eye, were so energetic, that I was obliged to hold on with all my strength, to keep myself in the houdah. The second barrel, too, of the gun which I still retained in my hand, went off in the scuffle, the ball passing close to the mahout's ear, whose situation, poor fellow, was any thing but enviable. As soon as my elephant was prevailed upon to leave the killing part of the business to the sportsmen, they gave the roughly used tiger the *coup de grace*. It was a very fine female, with the most beautiful skin I ever saw."

We shall only give another sketch of a tiger hunt; our last is told by a gentleman, this one shall be from the pen of a lady, herself the heroine of the chase, and will be curious, as we believe it is the only instance upon record.

"We had elephants, guns, balls, and all other necessaries prepared, and about seven in the morning we set off. The soil was exactly like that we had gone over last night; our course lay N. W. The jungle was generally composed of *corinda* bushes, which were stunty and thin; and looked like ragged thorn bushes; nothing could be more desolate in appearance; it seemed as if we had got to the farthest limits of cultivation, or the haunts of man. At times, the greener branches of jungle, the usual abodes of the beasts of prey during the day-time, and the few huts scattered here and there, which could hardly be called villages, seemed like islands in the desert waste around us. We stopped near two or three of these green tufts, which generally surrounded a lodgment of water, or little ponds, in the midst of the sand.

"The way in which these ferocious animals are traced out is very curious, and, if related in England, would scarcely be credited. A number of unarmed half-naked villagers, go prying from side to side of the bush, just as a boy in England would look after a strayed sheep, or peep after a bird's nest. Where the jungle was too thick for them to see through, the elephants, putting their trunks down into the bush, forced their way through, tearing up every thing by the roots before them. About four miles from our tents we were all surrounding a bush, which might be some fifty yards in circumference, (*all* includes William Fraser, alone upon his great elephant, Mr Barton and myself, upon another equally large, Mr Wilder upon another, and eight other elephants; horsemen at a distance, and footmen peeping into the bushes.) Our different elephants were each endeavouring to force his way through, when a great elephant without a *houdah* on his back, called 'Muckna,' a fine and much esteemed kind of elephant, (a male without large teeth,) put up, from near the centre of the bush, a royal tiger. In an instant Fraser called out, 'Now Lady H., be calm, be steady, and take a good aim, here he is.' I confess, at this moment of thus suddenly coming upon our ferocious victim, my heart beat very high, and, for a second, I wished myself far enough off; but curiosity, and the eagerness of the chase, put fear out of my head in a minute; the tiger made a charge at the Muckna, and then ran back into the jungle. Mr Wilder then put his elephant in, and drove him out at the opposite side. He charged over the plain away from us, and Wilder fired two balls at him, but knew not whether they took effect. The bush in which he was found, was one on the west bank of one of those little half dry ponds to lurk near such places where it has an opportunity of choosing its prey, or rather of multiplying its massacres. When it has killed one, it often goes to destroy others, swallowing their blood down at large draughts, and seeming rather glutted than satiated with its abundance.

However, when it has killed a large animal, such as a horse or a buffalo, it immediately begins to devour it on the spot, fearing to be disturbed. In order to feast at its ease, it carries off its prey to the forest, dragging it along with such ease, that the swiftness of its motion seems scarcely retarded by the enormous load it sustains. From this alone we may judge of its strength; but to have a more just idea of this particular, let us stop a moment to consider the dimensions of this most formidable creature. Some travellers have compared it for size to a horse, and others to a buffalo, while others have contented themselves with saying, that it is much larger than a lion. We have recent accounts of this animal's magnitude that deserve the utmost confidence. Mr Buffon has been assured by one of his friends, that he saw a tiger in the east Indies fifteen feet long. "Supposing that he means including the tail, this animal, allowing four feet for that, must have been eleven feet from the top of the nose to the insertion of the tail. Indeed, that which is now in the Tower is not so large, being, as well as I could measure, six feet from the tip to the insertion, and the tail was three feet more. Like all the rest of its kind, its motions are irregular and desultory; it bounds rather than runs; and, like them, rather chooses to take its prey by surprise, than to be at the trouble of hunting it down." How large a leap it can take at once we may easily judge, by comparing what it might do, to what we see so small an animal as the cat actually perform. The cat can leap several feet at a bound; and the tiger, who is ten times as long, can, no doubt, spring proportionably.

"The tiger is the only animal whose spirit seems untameable. Neither force nor constraint, neither violence nor flattery, can prevail in the least on its stubborn nature. The caresses of the keeper have no influence on its heart of iron: and time, instead of mollifying its disposition, only serves to increase its fierceness and malignity. The tiger snaps at the hand that feeds it, as well as that by which it is chastised; every object seems considered only as its proper prey, which it devours with a look; and, although confined by bars and chains, still makes fruitless efforts, as if to show its malignity when incapable of exerting its force."

To give a still more complete idea of the strength of this terrible creature, we shall quote a passage from Father Tachard, who was an eye-witness of a combat between a tiger and three elephants at Siam. For this purpose, the king ordered a lofty palisade to be built of bamboo cane, about a hundred feet square; and in the midst of this were three elephants appointed for combating the tiger. Their heads, and a part of their trunk, were

---

of which I have spoken. Mr Barton and I conjecturing that, as there was no other thick cover near, he would probably soon return, took our stand in the centre of the open space; in a minute the tiger ran into the bushes on the east side; I saw him quite plain; we immediately put our elephant into the bushes, and poked about, till the horsemen, who were reconnoitering round the outside of the whole jungle, saw him slink under the bushes to the north side; hither we followed him, and from thence traced him by his growling, back to the outer part of the eastern bushes. Here he started out just before the trunk of our elephant, with a tremendous growl or grunt, and made a charge at another elephant farther out on the plain, retreating again immediately under cover. Fraser fired at him, but we suppose without effect; and he called to us for our elephant to pursue him into his cover.

"With some difficulty, we made our way to the inside of the southern bushes: and, as we were looking through the thicket, we perceived beau tiger slink away under them. Mr Barton fired, and hit him a mortal blow about the shoulder or back, for he instantly was checked, and my ball, which followed the same instant, threw him down. We two then discharged our whole artillery, which originally consisted of two double-barrelled guns, loaded with slugs, and a pair of pistols. Most of them took effect, as we could discover by his wincing, for he was not above ten yards from us at any time, and at one moment, when the elephant chose to take fright and turn his head round, away from the beast, running his haunches almost into the bush, not *five*. By this time William Fraser had come round, and discharged a few balls at the tiger, which lay looking at us, grinning and growling, his ears thrown back, but unable to stir. A pistol fired by me, shattered his lower jaw-bone; and immediately, as danger of approaching him was now over, one of the villagers, with a matchlock, went close to him, and applying the muzzle of his piece to the nape of his neck, shot him dead, and put him out of his pain. The people then dragged him out, and we dismounted to look at him, pierced through and through; yet one could not contemplate him without satisfaction, as we were told that he had long infested the high road, and carried off many passengers. One hears of the *roar* of a tiger, and fancies it like that of a bull, but, in fact, it is more like the grunt of a hog, though twenty times louder, and certainly one of the most tremendous animal noises one can imagine."

The tiger is readily tamed when taken young, but its temper may be said to be scarcely so much depended upon as that of the lion. Keepers enter the cage and caress them, but they never venture upon those annoying liberties which are generally so freely taken with the lion; and strangers, I believe, have never attempted to venture within their reach. It may also be remarked, that there is only one instance upon record where the tiger allowed a dog to become an inmate of his den. With the lion it is frequent, and great affection is displayed. On the contrary, however, the Indians appear to have great power in the management of the tiger, and it is more frequently seen tame in that country than any of the other *Felinæ*.—*The Naturalist's Library* (*Felinæ*) *By Sir William Jardine, Bart. Edin.* 1834. 12*mo*.

covered with a kind of armour, like a mask, which defended that part from the assaults of the fierce animal with which they were to engage. As soon, says this author, as we were arrived at the place, a tiger was brought forth from its den, of a size much larger than we had ever seen before. It was not at first let loose, but held with cords, so that one of the elephants approaching, gave it three or four terrible blows with its trunk on the back, with such force that the tiger was for some time stunned, and lay without motion, as if it had been dead. However, as soon as it was let loose, and at full liberty, although the first blows had greatly abated its fury, it made at the elephant with a loud shriek, and aimed at seizing his trunk. But the elephant, wrinkling it up with great dexterity, received the tiger on his great teeth, and tossed it up into the air. This so discouraged the furious animal, that it no more ventured to approach the elephant, but made several circuits round the palisade, often attempting to fly at the spectators. Shortly after, three elephants were sent against it, and they continued to strike it so terribly with their trunks, that it once more lay for dead; and they would certainly have killed it, had not there been a stop put to the combat.

From this account, we may readily judge of the strength of this animal, which, although reduced to captivity, and held by cords; though first disabled, and set alone against three; yet ventured to continue the engagement, and even that against animals covered and protected from its fury.

"Captain Hamilton informs us, that in the Sandah Rajah's dominions there are three sorts of tigers in the woods, and that the smallest are the fiercest. This is not above two feet high, appears to be extremely cunning, and delights in human flesh. The second kind is about three feet high, and hunts deer and wild hogs, besides the little animal which has been already described under the name of the *chevrotain*, or *Guinea deer*. The tiger of the largest sort is above three feet and a half high; but, although endowed with greater powers, is by no means so rapacious as either of the former. This formidable animal, which is called the *royal tiger*, (one of which we have at present in the Tower,) does not seem so ravenous nor so dangerous, and is even more cowardly. A peasant in that country, as this traveller informs us, had a buffalo fallen into a quagmire, and while he went for assistance, there came a large tiger, that with its single strength drew forth the animal; which the united force of many men could not effect. When the people returned to the place, the first object they beheld was the tiger, who had thrown the buffalo over its shoulder, as a fox does a goose, and was carrying it away, with the feet upward, towards its den; however, as soon as it saw the men, it let fall its prey, and instantly fled to the woods: but it had previously killed the buffalo, and sucked its blood; and, no doubt, the people were very well satisfied with its retreat. It may be observed, that some East Indian buffaloes weigh above a thousand pounds, which is twice as heavy as the ordinary run of our black cattle, so that from hence we may form a conception of the enormous strength of this rapacious animal, that could thus run off with a weight at least twice as great as that of itself.

"Were this animal as common as the panther, or even as the lion himself, thus furnished as it is with the power to destroy and the appetite for slaughter, the country would be uninhabitable where it resides. But luckily the species is extremely scarce; and has been so since the earliest accounts we have had of the tiger. About the times of Augustus, we are assured by Pliny,[1] that when panthers were brought to Rome by hundreds, a single tiger was considered as an extraordinary sight; and he tells us, that the emperor Claudius was able to procure four only; which shows how difficultly they were procured. The incredible fierceness of this animal may be, in some measure, the cause of the scarcity which was then at Rome, since it was the opinion of Varro, that the tiger was never taken alive:[2] but its being a native only of the East Indies, and that particularly of the warmer regions, it is not to be wondered that the species should be so few."

We may, therefore, consider the species of the true streaked tiger, as one of the scarcest of animals, and much less diffused than that of the lion. As to the number of its young, we have no certain accounts; however, it is said, that it brings forth four or five at a time. Although furious at all times, the female, upon this occasion, exceeds her usual rapacity; and, if her young are taken from her, she pursues the spoiler with incredible rage; he, to save a part, is contented to lose a part, and drops one of her cubs, with which she immediately returns to her den, and again pursues him; he then drops another, and by the time she has returned with that, he generally escapes with the remainder. If she loses her young entirely, she then becomes desperate, boldly approaches even the towns themselves, and commits incredible slaughter. The tiger expresses its resentment in the same manner as the lion; it moves the muscles and skin of its face, shows its teeth, and shrieks in the most frightful manner. Its note is very different from that of the lion; being rather a scream than a roar: and the ancients expressed it very well, when they said, that *tigrides indomitæ rancant, rugiuntque leones*.

---

[1] Plin. Hist. Nat. lib. viii. c. 17.

[2] Tigris vivus capi adhuc non potuit. Var. de Ling. La.

The skin of these animals is much esteemed all over the East, particularly in China; the mandarins cover their seats of justice in the public places with it, and convert it into coverings for cushions in winter. In Europe, these skins, though but seldom to be met with, are of no great value, those of the panther and the leopard being held in much greater estimation. This is all the little benefit we derive from this dreadful animal, of which so many falsehoods have been reported; as, that its sweat was poisonous, and the hair of its whiskers more dangerous than an envenomed arrow. But the real mischiefs which the tiger occasions while living are sufficient, without giving imaginary ones to the parts of its body when dead. In fact, the Indians sometimes eat its flesh, and find it neither disagreeable nor unwholesome.

There is an animal of America, which is usually called the *red tiger*, but Mr Buffon calls it the *cougar*, which, no doubt, is very different from the tiger of the East. Some, however, have thought proper to rank both together, and I will take leave to follow their example, merely because the cougar is more like a tiger in every thing, except the colour, than any other animal I know, having the head, the body, and the neck, shaped very much in the same manner. Of these slight differences, words would give but a very faint idea; it will be, therefore, sufficient to observe, that they are both equally slender, and are smaller where the neck joins the head, than others of the panther kind. There is one at present in the Tower; and it seemed to me, as I could see it through the bars, that were it properly streaked and coloured, it would in all things resemble a small tiger. It is, however, of a very different colour, being of a deep brown, and the tail very long and pointed. It is rather darker on the back; under the chin it is a little whitish, as also on the lower part of the belly.

Of all the American animals, this is the most formidable and mischievous; even their pretended lion not excepted; it is said, there are several sorts of them; and, as well as I can remember, I have seen one or two here in England, both differing from the present, in size and conformation. It is, indeed, a vain endeavour to attempt to describe all the less obvious varieties in the cat kind. If we examine them minutely, we shall find the differences multiply upon us so much, that, instead of a history, we shall only be paid with a catalogue of distinctions. From such of them as I have seen, within these last six years, I think I could add two animals of this species, that have not been hitherto described, and with the names of which he that showed them was utterly unacquainted. But it is a poor ambition, that of being eager to find out new distinctions, or adding one noxious animal more, to a list that is already sufficiently numerous. Were the knowing a new variety to open an unknown history, or in the least to extend our knowledge, the inquiry would be then worth pursuing; but what signifies mentioning some trifling difference, and from thence becoming authors of a new name, when the difference might have originally proceeded either from climate, soil, or indiscriminate copulation?[1]

---

[1] Among the varieties of the tiger are the Clouded Tiger, (see Plate XIII. fig. 58) and the Jaguar and Puma of America. The Jaguar is very like the panther or leopard of the Old World, but the spots or rings of the former are larger and more oblong, particularly down the back, and those near the dorsal line have a central black dot, which is never seen in the panther or leopard; the head is rounder; the animal altogether stouter and stronger; and the tail never reaches farther than to the ground, which last is, perhaps, the most obvious difference between them.

There is also a black variety found in the forests on the frontiers of Brazil, which has the same spots and marks as the others, on a ground of a somewhat browner black; so that they are visible only on close examination, and by viewing the skin when inclining at a certain angle from the direction of the light. The black variety, however, is extremely rare. One is also mentioned by Azara, perfectly white, with the spots indicated by a more opaque appearance; but this peculiarity was possibly the effect of albinism.

The jaguars are solitary animals, or are met with only in pairs; they inhabit thick forests, especially in the neighbourhood of great rivers; and if they be driven by their wants to seek for sustenance in the cultivated country, they generally do so by night. It is said they will stand in the water, out of the stream, and drop their saliva, which, floating on the surface, draws the fish after it within their reach, when they seize them with the paw, and throw them on shore for food. They will attack cows, and even bulls of four years old, but horses seem to be their favourite prey. They destroy the larger animals by leaping on their back; and placing one paw on the head, and another on the muzzle, they contrive to break the neck of their victim in a moment. Having thus deprived it of life, they will drag the carcass, by means of their teeth, a very considerable distance, to their retreat, from which their great strength may, in some measure, be estimated.

The jaguar is hunted with a number of dogs, which, although they have no chance of destroying it themselves, drive the animal into a tree, provided it can find one a little inclining, or else into some hole. In the first case, the hunters kill it with fire-arms or lances; and in the second, some of the natives are occasionally found hardy enough to approach it with the left arm covered with a sheepskin, and to spear it with the other; a temerity which is frequently followed with fatal consequences to the hunter.

The travellor, who is unfortunate enough to meet this formidable beast, especially if it be after sunset, has but little time for consideration. Should it be urged to attack by the cravings of appetite, it is not any noise, or a fire-brand, that will save him. Scarcely any thing but the celerity of a musket-ball will anticipate its murderous purpose. The aim must be quick and steady; and life or death depends on the result.

The cougars are extremely common in South America; and, where the towns border upon the forest, these make frequent incursions by night into the midst of the streets, carrying off fowls, dogs, and other domestic creatures. They are, however, but weak and contemptible, compared to the great tiger, being found unable to cope with a single man. The Negroes and Indians are very dexterous in encountering them; and some, even for the sake of their skins, seek them in their retreats. The arms in this combat, seemingly so dangerous, are only a lance of two or three yards long, made of heavy wood, with the point hardened in the fire; and a kind of scimetar, of about three-quarters of a yard in length. Thus armed, they wait till the tiger makes an assault against the left hand, which holds the lance, and is wrapped up in a short cloak ot baize. Sometimes the animal, aware of the danger, seems to decline the combat; but then its antagonist provokes it with a slight touch of the lance, in order, while he is defending himself, to strike a sure blow. As soon, therefore, as the creature feels the lance, it grasps it with one of its paws, and with the other strikes at the arm which holds it. Then it is that the person nimbly aims a blow with his scimetar, which he kept concealed, with the other hand, and hamstrings the creature,

---

Many parts of South America which were once grievously pestered with jaguars, are now almost freed from them, or are only occasionally troubled with their destructive incursions.

Nearly approaching to the jaguar in size and form, but obviously distinguished from him at the first glance, by the total absence of spots, the puma cougar, or, as he was once called, the American Lion, occupies the second place among the cats of the New World, over nearly the whole of which he was formerly spread, from Canada and the United States in the North, to the very extremity of Patagonia in the South. From a large portion of this immense expanse of country he appears, however, to have been of late years in a great measure, if not entirely rooted out: and it is seldom that he is now heard of in the vicinity of that civilization, which involves, as a necessary consequence, either the complete extinction, or, at least, the gradual diminution and dispersion to more secure and sheltered habitations, of all the more savage and obnoxious beasts. For his title of the American Lion he was, in a great degree, indebted to an absurd notion on the part of the early colonists, which was even shared by many naturalists, that he was, in reality, neither more nor less than a degenerate variety of that far more noble animal. This opinion has, however, long since given way before the prevalence of sounder views; and he is now universally recognised as forming a species clearly distinguishable from every other, by a combination of characters which it is impossible to mistake.

Almost the only striking point of resemblance between him and the lion consists in the uniform sameness of his colour, which on the upper parts of his body is of a bright silvery fawn, the tawny hairs being terminated by whitish tips: beneath and on the inside of the limbs he is nearly white, and more completely so on the throat, chin, and upper lip. The head has an irregular mixture of black and gray; the outside of the ears, especially at the base, the sides of the muzzle from which the whiskers take their origin, and the extremity of the tail, are black. The latter is not terminated, as in the lion, by a brush of hair; neither has the puma any vestige of a mane. His length from the tip of the nose to the root of the tail is commonly about four feet, and his tail measures above half as much more, being just sufficiently long to suffer its extremity to trail upon the ground. His head is remarkably small and rounded, with a broad and somewhat obtuse muzzle; and his body is proportionably more slender and less elevated than that of the lion. His young, like those of the latter animal, have a peculiar livery, consisting in spots of a darker shade than the rest of their fur, scattered over every part of the body, but only visible in a particular light, and disappearing entirely at the adult age. There is no difference whatever in colour between the sexes, the fur of the female being in every respect similar to that of the male: in size the latter is superior to his mate; and his head, a part which in the female is disproportionately small, corresponds better with the general form of his body.

More circumspect, or rather more cowardly, than any of the larger species of his cautious tribe, he is, notwithstanding his much greater magnitude, scarcely more dangerous than the common wild cat, preying only upon the smaller species of animals, seldom venturing to attack any living creature of greater size or courage than a sheep, and flying from the face of man with more than usual terror. But this cowardice is also, in a state of nature connected with a degree of ferocity, fully equal to that which is developed in the most savage and bloodthirsty of his fellow-cats. Unlike the jaguar, which generally contents itself with a single victim, the puma, if he should happen to find himself undisturbed in the midst of a flock of sheep, deserted by their guardians and left entirely at his mercy, is said never to spare, but to destroy every individual that he can reach, for the purpose of sucking its blood. He differs also from the jaguar in his habit of frequenting the open plain rather than the forest and the river, in and near which the latter usually takes his secret and destructive stand. Hence he is more exposed to the pursuit of the skilful thrower of the lasso, from whom, as his swiftness is by no means great and his timidity excessive, he rarely escapes.

In captivity the puma readily becomes tame, and may even be rendered docile and obedient. His manners closely resemble those of the domestic cat; like it he is extremely fond of being noticed, raises his back and stretches his limbs beneath the hand that caresses him, and expresses his pleasure by the same quiet and complacent purring. They soon become attached to those with whom they are familiar; and numerous instances might be mentioned in which they have been suffered to roam almost at large about the house without any injurious results. Mr Kean, the tragedian, possessed an animal of this species so tame as to follow him about almost like a dog, and to be frequently introduced into his drawing-room, when filled with company, at perfect liberty.

which immediately draws back enraged, but instantly returns to the charge. But then receiving another stroke, it is totally deprived of the power of motion; and the combatant, killing it at his leisure, strips the skin, cuts off the head, and returns to his companions, displaying these as the trophies of his victory.

This animal, as we are assured, is often more successful against the crocodile ; and it is the only quadruped in that part of the world that is not afraid of the engagement. It must be no unpleasant sight to observe, from a place of safety, this extraordinary combat, between animals so terrible and obnoxious to man. Such as have seen it, describe it in the following manner. When the tiger, impelled by thirst, that seems continually to consume it, comes down to the river side to drink, the crocodile, which makes no distinction in its prey, lifts its head above water to seize it; the tiger, not less rapacious than the other, and unacquainted with the force of the enemy, boldly ventures to seize it, and plunges its claws into the eyes of the crocodile, which is the only vulnerable part of its body: upon this the crocodile instantly dives under water, and the tiger goes down with him, for it will sooner die than let go its hold. In this manner the combat continues for some time, until the tiger is drowned, or escapes, as is sometimes the case, from its disabled enemy.

These animals are common in Guiana.[1] They were formerly seen swimming over, in great numbers, into the island of Cayenne, to attack and ravage the flocks and herds of the inhabitants. In the beginning they were a terrible scourge to the infant colony ; but, by degrees, they were repulsed and destroyed, and are now seen no longer at that place. They are found in Brazil, in Paraguay, in the country of the Amazons, and in several other parts of South America. They often climb trees in quest of prey, or to avoid their pursuers. They are deterred by fire, like all other animals of the cat kind ; or, more properly speaking, they seldom venture near those places where they see it kindled, as they are always sure of their enemies being near, and their nocturnal eyes are dazzled by the brightness of the blaze. From the description of this animal, one would be hardly led to suppose that its flesh was good for food; and yet we have several accounts which allege the fact, some asserting it to be superior even to mutton: however, what Monsieur des Marchais observes, is most likely to be true ; namely, that the most valuable part of this animal is its skin, and that its flesh is but indifferent eating, being generally lean, and usually having a strong fumet.

THE PANTHER AND THE LEOPARD.[2]

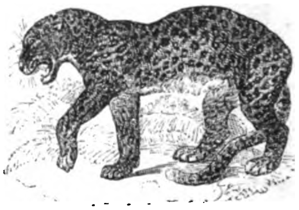
We have hitherto found no great difficulty in distinguishing one animal from another, each carrying its own peculiar marks, which, in some measure, serve to separate it from all

---

[1] Buffon, vol. xix. p. 22.

[2] The leopard of Southern Africa is known among the Cape colonists by the name of *tiger;* but is, in fact, the real leopard, the *felis jubata* of naturalists. It differs from the panther of Northern Africa in the form of its spots, in the more slender structure of its body, and in the legs not being so long in proportion to its size. In watching for his prey, the leopard crouches on the ground, with his fore-paws stretched out and his head between them, his eyes rather directed upwards. His appearance in his wild state is exceedingly beautiful, his motions in the highest degree easy and graceful, and his agility in bounding among the rocks and woods quite amazing. Of this activity no person can have any idea by seeing these animals in the cages in which they are usually exhibited in Europe, humbled and tamed as they are by confinement and the damp cold of our climate.

The leopard is chiefly found in the mountainous districts of South Africa, where he preys on such of the antelopes as he can surprise, on young baboons, and on the rock badgers or rabbits. He is very much dreaded by the Cape farmers also, for his ravages among the flocks, and among the young foals and calves in the breeding season.



The leopard is often seen at night in the villages of the negroes on the west coast; and being considered a sacred animal, is never hunted, though children and women are not unfrequently destroyed by him. In the Cape colony, where no such respect is paid him, he is shyer, and much more in awe of man. But though in South Africa he seldom or never ventures to attack mankind, except when driven to extremity (unless it be some poor Hottentot child now and then that he finds unguarded), yet in remote places, his low, half-smothered growl is frequently heard at night, as he prowls around the cottage or the kraal, as the writer of this notice has a hundred times heard it. His purpose on such occasions is to break into the sheep-fold, and in this purpose he not unfrequently succeeds, in spite of the troops of fierce watch-dogs which every farmer keeps to protect his flocks.

The leopard, like the hyæna, is often caught in traps constructed of large stones and timber, but upon the same principle as a common mouse-trap. When thus caught, he is usually baited with dogs, in order to train them to contend with him, and seldom dies without killing one or two of his canine antagonists. When hunted in the fields, he instinctively betakes himself to a tree, if one should be within reach. In this situation it is exceedingly perilous to approach within reach of his spring; but at the same time, from his exposed position, he becomes an easy prey to the shot of the huntsman.

The South African leopard, though far inferior to the lion or Bengal tiger in strength and intrepidity, and the rest. But it is otherwise when we come to these of the cat kind, that fill up the chasm between the tiger and the cat. The spots with which their skins are diversified, are so various, and their size so equivocal, that it is no easy matter to distinguish the species, particularly as we have little else but the spots and the size to guide us in making the distinction. If we regard the figure and diversity of the spots, we shall find many varieties not taken notice of by any naturalist; if we are led by the size, we shall find an imperceptible gradation from the cat to the tiger. It would be vain, therefore, to make as many varieties in these animals as we see differences in spots or nature; it will be sufficient to seize the most general distinctions, and leave the rest to such as are fond of more minute disquisitions.

Of all this tribe, whose skins are so beautifully spotted, and whose natures are so mischievous, the panther may be considered as the foremost. This animal has been by many naturalists mistaken for the tiger; and in fact, it approaches next to it in size, fierceness, and beauty. It is distinguished, however, by one obvious and leading character; that of being spotted, not streaked; for in this particular, the tiger differs from the panther, the leopard, and almost all the inferior ranks of this mischievous family.

This animal, which Mr Buffon calls simply the *panther;* Linnæus, the *pard;* Gessner, the *pardalis;* and the modern Latins, the *leopardus:* this animal, I say, which goes by too many names, and which the English have indiscriminately called by the name of the PANTHER or the LEOPARD, may be considered as the largest of the kind, and is spotted in a manner somewhat different from those that are smaller. As those spots, however, make the principal difference between it and the lesser animals, which it otherwise resembles in shape, size, disposition, and beauty, I will first show these slight distinctions, and mention the names each animal has received in consequence thereof; and then proceed to give their history together, still marking any peculiarity observable in one of the species which is not found in the rest.

Next to the great panther, already mentioned, is the animal which Mr Buffon calls the LEOPARD, a name which he acknowledges to be given arbitrarily, for the sake of distinction. Other naturalists have not much attended to the slight differences between this and the great panther, nor have they considered its discriminations as sufficient to entitle it to another name. It has hitherto, therefore, gone under the name of the LEOPARD or PANTHER of Senegal, where it is chiefly found. The differences between this animal and the former are these: the large panther is often found to be six feet long, from the tip of the nose to the insertion of the tail; the panther of Senegal is not above four. The large panther is marked with spots in the manner of a rose, that is, five or six make a kind of circle, and there is generally a large one in the middle. The leopard of Senegal has a much more beautiful coat, the yellow is more brilliant, and the spots are smaller, and not disposed in rings but in clusters. As to the rest, they are both whitish under the belly; the tail in both is pretty long, but rather longer in proportion in the latter than in the former. To these two animals, whose differences seem to be so very minute, we may add a third, namely, the JAGUAR, or PANTHER of America.[1] This, in every respect, resembles

---

though he usually shuns a conflict with man, is nevertheless an exceedingly active and furious animal, and when driven to desperation becomes a truly formidable antagonist. The Cape colonists relate many instances of frightful and sometimes fatal encounters beween the hunted leopard and his pursuers. The following is a specimen of these adventures. It occurred in 1822, when the present writer was in the interior of the colony, and is here given as it was related to him by an individual who knew the parties engaged in it.

Two African farmers, returning from hunting the hartebeest (*antilope bubalis*), roused a leopard in a mountain ravine, and immediately gave chase to him. The leopard at first endeavoured to escape by clambering up a precipice; but being hotly pressed, and wounded by a musket-ball, he turned upon his pursuers with that frantic ferocity peculiar to this animal on such emergencies, and springing on the man who had fired at him, tore him from his horse to the ground, biting him at the same time on the shoulder, and tearing one of his cheeks severely with his claws. The other hunter seeing the danger of his comrade, sprang from his horse and attempted to shoot the leopard through the head; but, whether owing to trepidation, or the fear of wounding his friend, or the quick motions of the animal, he unfortunately missed. The leopard, abandoning his prostrate enemy, darted with redoubled fury upon his second antagonist, and so fierce and sudden was his onset, that before the boor could stab him with his hunting knife, the savage beast struck him on the head with his claws, and actually tore the scalp over his eyes. In this frightful condition the hunter grappled with the leopard; and, struggling for life, they rolled together down a steep declivity. All this passed far more rapidly than it can be described in words. Before the man who had been first attacked could start to his feet and seize his gun, they were rolling one over the other down the bank. In a minute or two he had reloaded his gun, and rushed forward to save the life of his friend. But it was too late. The leopard had seized the unfortunate man by the throat, and mangled him so dreadfully, that death was inevitable; and his comrade (himself severely wounded) had only the melancholy satisfaction of completing the destruction of the savage beast, already exhausted with the loss of blood from several deep wounds by the desperate knife of the expiring huntsman.—*From an article by Mr Pringle in the Penny Magazine.*

[1] Buffon has mistaken the jaguar, which he describes from an ocelot; and refers the former animal, because, probably, it was a large species, to the panther of the

the two former, except in the disposition of its spots, and that its neck and head are rather streaked than spotted. The jaguar is also said to be lower upon its legs, and less than the leopard of Senegal. These three quadrupeds, as we see, have but very slight differences, and the principal distinction used by Mr Buffon is taken from the size: the first, as he says, is usually six feet long; the second, four feet; and the last about three; however, it appears from the particular subjects of his description, that the panther in his possession was not above three feet seven inches long: that the leopard's skin which he describes was about four; and that the jaguar, at two years old, was between two and three feet long, which, when come to its full growth, would, no doubt, be four feet long, as well as the two former. From hence, therefore, we may conclude, that the size in these animals is not sufficient to make a distinction among them; and that those who called them all three by the indiscriminate names of the leopard and the panther, if not right, were at least excusable. Of those which are now to be seen in the Tower, the jaguar, or the American panther, is rather the largest of the three, and is by no means the contemptible animal which Mr Buffon describes it to be; the leopard is the least of them, and has, by some travellers, been supposed to be an animal produced between the panther and the ounce, an animal which it resembles, but is less than any of the former. These three animals we may, therefore, rank together, as they agree pretty nearly in their robe, their size, their dispositions, and their ferocity.

We come next to an animal confessedly different from any of the former, being much smaller, and its colour more inclining to white. Its name, however, in our language, has caused no small confusion. It has been generally called by foreigners the ONZA, or the OUNCE, and this name some of our own writers have thought proper to give it: but others of them, and these the most celebrated, such as Willoughby, have given this name to a different animal, with a short tail, and known to the ancients and moderns by the name of the *lynx*. I confess myself at a loss, in this case, whom to follow; the alteration of names should be always made with great caution, and never but in cases of necessity. If we follow Willoughby, there will be an animal of the panther kind, very distinguishable from all the rest, left without a name; and if we recede from him, it will serve to produce some confusion among all the numerous class of readers and writers who have taken him for their guide; however, as he seems himself

---

ancients, transporting his figures accordingly. The furriers and exhibiters of wild beasts have imbibed this error; and the jaguar of America has altogether usurped the name of panther from the species of the old world, to which it was originally applied.

The animals of the cat kind are, in general, strongly marked, but inclinations are to be found in certain of its species both to the dogs and the viverræ; the Chetah or Maned hunting leopard is the type of the former. In the system of dentition, and all the organs of sense, it corresponds with the felinæ, but in the non-retractibility of the claws, it differs from the genus in general. In this species, we have, in a remarkable manner, the opportunity of observing the mutual harmony existing between the mental impulses and the physical powers of animals; their disposition or inclination to destruction is precisely in unison and proportion with their bodily powers. If very weak, they are excessively timid; if extremely strong, they are equally undaunted; while those which hold a medium station in this respect seem generally to appreciate, as it were, with more sobriety, the conditions of their existence, and to submit themselves to the dominion and artificial education of man more easily than the rest. The hunting leopard is in this intermediate situation. About as big as a large dog, its leading weapons of offence, the claws, are in the same situation as those of that animal; incapable of being withdrawn into a sheath for protection, they are constantly exposed to the friction of the ground, by which they become worn and blunt, and so much the less effectual for active warfare; but otherwise the animal has all the suppleness and elasticity, the trenchant teeth, and the powerful jaws of the cats. Partially deficient, therefore, in the physical powers of its congeners, it is equally wanting in the extreme ferocity of its disposition.

The hunting leopard is of a pale yellow colour on the upper part, white underneath, and covered all over with very small spots without regularity; it has a slight erect mane down the neck, whence it is named. The eye-pupil is round at all times. The slim make of the body and limbs of this animal, calculated apparently rather for speed than strength, assimilate it in a remarkable degree to the canine race, with which we have already compared it. In a certain aptness or capability it possesses of being trained for field sports, it is also more like the dogs than the cats. It is, therefore, strictly speaking, intermediate, and we appear to pass naturally from the latter race of animals through this species to the former. It also exhibits the first step or remove from the perfect fitness for carnivorous and predatory habits in the loss of the retractile power of the talons. Of the habits of the hunting leopard in a state of nature, we have no certain information; but in his tamed and domesticated condition, he has been rendered, in some countries at least, auxiliary to man, by the successful cultivation of his mental faculties, which have been trained into a degree of subservience to the commands of his master, that can only be surpassed by the superior sagacity of the hound.

The chetah has been, until of late years, very imperfectly known in Europe. Linnæus was entirely unacquainted with it, and Buffon described it from the fur alone, under the name of *guepard*, the appellation by which its skin was distinguished in the commerce with Senegal, but evidently without suspecting its identity with the Asiatic animal, the trained habits of which, misled probably by the authority of Tavernier, he erroneously attributed to his imaginary ounce. Subsequent French zoologists had rectified this error, and it was generally believed that the tamed leopard of Bernier, the youze, the guepard, and Tavernier's ounce, were one and the same animal; but it was not until a year or two ago that the possession of a living specimen, brought from Senegal, in the Menagerie of the Jardin du Roi, enabled M. F. Cuvier to ascertain its characters with precision.

to have been an innovator, the name of the lynx having been long adopted into our language before, it was unnecessary to give the animal that bore it another name, and to call that creature an ounce, which our old writers had been accustomed to know by the Latin appellation; for this reason, therefore, we may safely venture to take a name that has been long misapplied, from the lynx, and restore it to the animal in question. We will, therefore, call that animal of the panther kind, which is less than the panther, and with a longer tail, the *ounce;* and the lynx may remain in possession of that name by which it was known among all our old English writers, as well as by all antiquity.

The OUNCE, or the ONSA of Linnæus, is much less than the panther, being not at most above three feet and a half long; however, its hair is much longer than that of the panther, and its tail still more so. The panther of four or five feet long, has a tail of but two feet, or two feet and a half; the ounce, which is but about three feet, has a tail often longer than the rest of its body. The colour of the ounce is also apparently different, being rather more inclining to a cream-colour, which is deeper on the back, and whiter towards the belly. The hair on the back is an inch and a half long, and that on the belly two inches and a half, which is much longer than that of the panther. Its spots are disposed pretty much in the same manner as the large panther, except that on the haunches it is rather marked with stripes than with spots.

Descending to animals of this kind that are still smaller, we find the CATAMOUNTAIN, which is the ocelot of Mr Buffon, or the tiger-cat of most of those who exhibit it as a show. It is less than the ounce, but its robe more beautifully variegated. It is an American animal, and is about two feet and a half in length from the nose to the insertion of the tail. It is extremely like a cat, except that it is larger and slenderer, that its colours are more beautiful, and its tail rather shorter. The fur is of a reddish colour, the whole beautified with black spots, and streaks of different figures. They are long on the back, and round on the belly and paws. On the ears are black stripes, which run across; but in other respects, they entirely resemble those of a cat. These colours, however, which naturalists have taken great pains minutely to describe, are by no means permanent, being differently disposed in different animals of the same species. I remember to have seen an animal of this size, but whether of this species I will not pretend to say, some years ago, that was entirely brown, and was said also to have come from America.

From this tribe of the cat kind, with spotted skins and a long tail, we come to another, with skins diversified in like manner, but with a shorter tail. The principal of these is the LYNX, the name by which the animal was known to Ælian, among the ancients; and to all our old English writers among those of a more modern date.[1] This name has been cor-

---

[1] The Lynxes form a small section in the very extensive genus *felis*, or cat tribe of animals, in which they are principally distinguished by the length of the fur, the shortness of the tail, and by the brushes of hair with which their ears are furnished. There are several varieties in this species, distinguished from one another by differences in the size of the animal, in the length and colour of the fur, and in the length of the tail and of the brushes of hair which decorate the ears. Some of the circumstances of difference appear to be merely the result of climate. Thus, as it regards the fur, which is in general much esteemed, as an article of commerce, for its warmth and softness, it is observed to be lighter in colour, and more distinctly spotted, the nearer the *habitat* of the animal is to the north. Others, again, are smaller, have less fur, and show the dark colour more distinctly. It also appears that the fur of the same animal differs very much in different seasons of the year. In this, as in other species of animals, varieties seem to have been unnecessarily multiplied by a reference to mere accidental or unessential circumstances; and one of the first effects which may be anticipated from a more diffused knowledge of the principles by which observations in natural history should be regulated, will be to diminish rather than to enlarge the number of the varieties which many species of animals have been supposed to contain.

The lynx is about the size of a moderately large dog, measuring about two feet and a half from the head to the commencement of the tail, which is about six inches long, being shorter than the thighs. The height to the withers is from sixteen to eighteen inches. The legs and feet are very thick and strong; and the eyes, which are proverbially piercing, are of a pale yellow colour. The long and soft fur is generally of a bright red colour, marked on the back and limbs with blackish-brown spots; three lines of black spots on the cheeks join a large black oblique band on each side of the neck under the ear: the fur of these parts is longer than elsewhere, and forms a kind of lateral beard. The forehead and top of the head are dotted with black; and on the top of the neck there are four lines of the same colour, the middlemost of which is broken and interrupted. The dark spots form two oblique bands on the shoulders, and transverse bands on the fore-legs. The feet are yellow and without spots, but the tarsus of the hind-feet has a brown band. The outsides of the ears are black at the base and tip, and ashy in the middle. The tail, which is yellowish-white underneath, is tipped and ringed with black. The fur inclines to white on the throat, breast, and belly, and the eyes are surrounded with white. This description must be understood to apply generally to the common lynx, and even in this there

rupted by the Portuguese into the word *onze;* and this corruption has been adopted by Ray, who has improperly called this animal the *ounce*, after some of the foreign travellers. The first striking distinction between the lynx, and all those of the panther kind, is in its tail, which is at least half as short in proportion, and black at the extremity. Its fur is much

---

are considerable departures from this general standard. Some have the spots only of a little deeper red than the ground colour, and in others the marks differ much in form and depth of colour.

The lynx was formerly spread over the Old world. It was common in France, and has only disappeared from Germany at a comparatively recent period. It is still found in the north of Europe, and even in Portugal and Spain. Cuvier describes one that was killed within a few leagues of Lisbon, and M. Bory de St Vincent mentions that he frequently met with them in the central and southern mountains of Spain. They there attain to a larger size than usual, and their colours are remarkably vivid. It is very common in the forests of northern Asia, and in the Caucasus. That which inhabits the more southern parts of Asia, and is found in Africa, is a rather distinct variety called *caracal*, a contraction of the Turkish name *kara*, black, and *kulack*, ear. It is chiefly distinguished by its uniform vinous red colour, by its ears, which are black both without and within, and by a longer tail than any other lynx possesses. America is known to have two, or perhaps three, varieties of the lynx. The first is that which, after Buffon, is called the Canada lynx. Its colour is grey, its tail is longer than that of the common lynx, and the hairs on the ears are shorter. Some individuals have the fur so thick and long, especially on the paws, that they have a very different appearance from the European lynx; the identity of which with this species is asserted by some naturalists and disputed by others. It is found in great abundance in the districts about Hudson's Bay, from whence from 7000 to 9000 skins are yearly exported. It is a timid creature, and makes but slight resistance when brought to bay by the hunter; for though, like the cat, it spits and erects the hair on its back, it is easily destroyed with a slender stick. The other variety (*felix rufa*) which is found in the United States, is smaller than the one just mentioned. It has the form and distribution of spots of our European variety; but the ground colour is gray; its spots are more numerous, deeper on the back, and paler on the sides and limbs.

In their manners and habits of life the varieties differ little from one another; but the following statement will be understood as more especially applying to the common lynx.

The physiognomy of the lynx is rather gentle than savage. Alluding to ancient fables, Buffon remarks, "Our lynx is not able to see through walls, but it is quite true that he has very brilliant eyes, with a mild look and an agreeable and cheerful air." The animal may indeed be considered much less ferocious than most others of the genus to which it belongs. It has the soft stealthy walk of the cat, and leaps or bounds in the same manner. It lives by hunting, and often follows to the tops of the highest trees the wild cats, martins, ermines, squirrels, &c., which form its customary prey. It also watches the approach of deer, goats, hares, and other animals, and as they pass, drops down upon them from the branches of trees, where it conceals itself. Among its contrivances to obtain food, it is mentioned that it frequently digs under the doors to gain admission to the sheep-folds. When urged by hunger, it has been known to prey even on its own species. It is passionately fond of blood, and when it has secured its prey is said frequently to suck the blood from the throat, and then leave the carcass otherwise untouched, to go in search of another victim. It perhaps arose from this, that the lynx has been said, in old fables, to have the least memory of any animal—a statement quite on a par with the other very extraordinary particulars concerning it which for a long period formed a part of the popular belief, and are still prevalent amongst ill-informed people. It is said that when the lynx does devour any part of a goat or sheep after having sucked the blood, the brain, the liver and the intestines are the portions which it prefers. The caracal, which is a native of warmer climates than those in which the common lynx is found, presents some peculiarities in its mode of obtaining food, which it may be here desirable to state. It appears that although its disposition is considerably more ferocious than that of the common lynx, it does not like the trouble of taking its own prey, but, when opportunities offer, follows the lions, and feasts on the remains of his meal. Like the jackal, the caracal has been supposed to conduct the lion to the prey of which it afterwards partakes, and it has hence been called the "lion's guide or purveyor." It is said to approach very near to the lion with considerable boldness, which is accounted for by the consciousness of security from the anger of the lordly beast which it derives from the facility with which it can escape up the trees where the lion cannot follow. It is observed, however, that the caracal studiously shuns the panther, as that animal is equally well adapted for climbing with itself. These circumstances do not perhaps denote any inherent difference of habits between the caracal and the common lynx, but may have resulted from the accident of the existence of the former in the same countries with the lion. The absence of the lion from the countries inhabited by the lynx necessarily precludes the latter from the advantage enjoyed by the caracal. We mention this because it is useful to remember that when similar animals have, in different climates, different modes of life, it is not necessary to infer a corresponding difference of propensities or dispositions, unless we find that there are no external circumstances which adequately account for such differences as actually appear.

The sight of the lynx is certainly very quick, and it sees its prey at a great distance. Among the thousand marvellous stories which the old naturalists relate, and which the ignorant and credulous have been willing to believe, one was, that the lynx could see through opaque bodies; and another, that its urine was converted into precious stones. There was a time, not very remote, when, in mentioning such old fables, it would have been necessary to have said something to disprove them; but we are thankful and happy that at the present time this is perfectly unnecessary.

The howl of the common lynx has a considerable resemblance to that of the wolf. When assailed, it is by no means so passive as the lynx of Canada. When attacked by a dog, it lies down on its back, and strikes so desperately with its claws, that it frequently compels the assailant to withdraw. This is true also of the caracal; and Dr Charleton mentions one that killed a hound, and tore it instantly in pieces, notwithstanding that it made a most vigorous defence. The lynx is, in general, exceedingly ferocious in a state of captivity; it frequently expresses its malignity by a kind of snarling scream, and is seldom or perhaps never tamed. In the East the caracal is sometimes partially tamed, when taken young and reared with extreme caution, and is then trained to assist in the chase. It is capable of rendering very effectual service in hunting the smaller quadrupeds; but when it encounters one which it judges to be superior to itself in strength, it loses its courage and gives over the chase.

longer, the spots on the skin less vivid, and but confusedly mingled with the rest. Its ears are much longer, and tipped at the points with a black tuft of hair. The colour round the eyes is white, and the physiognomy more placid and gentle. Each hair of this animal is of three different colours: the root is of a grayish brown; the middle red, or of an ash colour; and the ends white. This whiteness at the ends takes up so small a part of the particular hair, that it does not prevent us from seeing the principal colour, which is that of the middle part; so that it only makes the surface of the body appear as if it were silvered over; however, the hair of which the spots consist has no white at the ends, and at the roots it is not quite so black as the other part. This animal is not above the size of the ounce, but is rather stronger built, and it has but twenty-eight teeth; whereas all the rest of the cat kind already mentioned have thirty.

Another animal of this kind is called the SIAGUSH, or, as Mr Buffon names it, the CARACAL. It is a native of the East Indies, and resembles the lynx in size, in form, and even in the singularity of being tufted at the tips of the ears. However, the siagush differs in not being mottled as the lynx is; its fur, or rather hair, is rougher and shorter; its tail is rather longer; its muzzle more lengthened; its physiognomy more fierce, and its nature more savage.

The third and last animal that needs to be mentioned of this kind, is that which Mr Buffon calls the SERVAL, and which he has first described. It is a native of Malabar, resembling the panther in its spots, but the lynx in the shortness of its tail, in its size, and in its strong-built form.

These seem to be all the principal distinctions among animals of the panther kind, from the largest of this tribe down to the domestic cat, which is the smallest of all these fierce and mischievous varieties. In all, their nature seems pretty much the same; being equally fierce, subtle, cruel, and cowardly. The panther, including the leopard and the jaguar, or American panther, as they are the largest, so also are they the most dangerous of this kind, for the whole race of cats are noxious in proportion to their power to do mischief. They inhabit the most torrid latitudes of India, Africa, and America, and have never been able to multiply beyond the torrid zone. They are generally found in the thickest and most entangled forests, and often near remote habitations, where they watch to surprise all kinds of domestic animals. They very seldom attack man, even though provoked by him; they seem rather desirous of finding safety by flight, or by climbing trees, at which they are very expert. In this manner also they often pursue their prey, and, being expert at seizing it, as well above as below, they cause a vast destruction. Of all other animals, these are the most sullen, and even to a proverb, untameable. They still preserve their fierce and treacherous spirit; and at those places where they are exposed to be seen among others, we often observe, that while their keeper is familiar with the lion or the bear, yet he is apprehensive of the large panther, and keeps it bound with the shortest chain.

As the ounce differs from these in figure and size, so also it seems to differ in disposition, being more mild, tractable, and tame. These we often see as harmless and innocent as cats; and there is one at present in the Tower with which the keeper plays without the smallest apprehension. I own I was not a little uneasy at first for the man, when he put his hand through the bars, and called the animal by its name; but was a good deal surprised to see the creature, which one might suppose irritated by long confinement, come gently up to him, stroke his hand with its face, in the manner of a cat, and testify the utmost gentleness of disposition. The ounce, therefore, is remarkable for being easily tamed; and, in fact, it is employed all over the East for the purposes of hunting. Not, indeed, but that panthers themselves are sometimes used for this purpose, but they are never thoroughly subdued like the former, being usually brought to the field in a carriage, and kept chained and caged until they are shown the gazelle, or the leveret, which is their prey. This they pursue rather by three or four great springs than by running. If they seize it by this sudden effort, it finds no mercy; but if it escapes from their first effort, they never attempt to pursue, and appear quite disappointed and confounded at their mischance. It sometimes happens that they are so much enraged at it, that they attack even their employer, and his only resource to avoid their fury is to throw them some small pieces of meat, which he has brought with him for that purpose.

The ounce, however, is not so dangerous; and is treated with more confidence and fami-

---

Some naturalists have taken the trouble to inquire which variety of the lynx the ancient writers had in view in their various descriptions, and in the fables to which we have alluded. We quite concur in the view which Buffon has taken of this matter. After mentioning the fables in question, he says:—"This lynx is a fabulous animal, as well as all the properties attributed to it. This imaginary lynx has no resemblance to the true lynx except in the name. It does not therefore appear necessary to follow the majority of naturalists in attributing to a real animal the properties of one entirely imaginary. It should not be forgotten that Pliny himself scarcely speaks like one who believed in its existence, and classes it with the sphinxes, the pegasuses, the unicorns, and other prodigies and monsters to which Ethiopia gave birth." *Penny Magazine.*

liarity. It is usually brought to the field hoodwinked behind one of the horsemen. When the game appears, the ounce is instantly uncovered, and shown where it lies: upon which the fierce creature darts like an arrow to the place, and seizes it at once, or, missing it, remains motionless on the place. It would be vain to attempt retrieving its disgrace, by continuing the pursuit; for, although it bounds with greater agility than most other animals, yet it is slow and awkward in running, and has no means of finding the animal it pursues by the smell, as is common among those of the dog kind. From hence, therefore, it appears, how much superior the European method of hunting is to that of the Asiatic; since whatever amusement this exercise affords must arise from the continuance of the chase, and from the fluctuation of doubt and expectation, which raise and depress the pursuers by turns. All this an Asiatic hunter is deprived of; and his greatest pleasure can scarcely be more than what among us is called *coursing*, in which the dog pursues the animal, and keeps it constantly in view.

But it must not be supposed that it is from choice the Asiatics use this method of chase; for, no doubt, were dogs serviceable among them as they are in Europe, they would be employed for the same purposes. But the fact is, that the extreme heat of the tropical climates produces such universal putrefaction, and sends up such various and powerful scents, that dogs are at first bewildered in the chase, and, at last, come to lose the delicacy of their scent entirely. They are, therefore, but little used in those warm countries; and what could they avail in places where almost every other animal of the forest is stronger and more rapacious? The lion, the tiger, the panther, and the ounce, are all natural enemies to the dog, and attack him wherever he appears with ungovernable fury. The breed, therefore, in those places would quickly be destroyed; so that they are obliged to have recourse to those animals which are more fitted to serve them; and thus convert the ounce to those purposes for which dogs are employed in Europe.

The CATAMOUNTAIN, or OCELOT, is one of the fiercest, and, for its size, one of the most destructive animals in the world.[1] It is, as was before observed, a native of South America, and by no means capable of the same education as the ounce, which it more approaches in size than in disposition. Two of these, from whom Mr Buffon has taken his description, were brought over from Carthagena, and having been taken from the dam when very young, were afterwards suckled by a bitch. But, before they were three months old, they had strength and ingratitude enough to kill and devour their nurse. Their succeeding fierceness and malignity seemed to correspond with their first efforts; for no other arts could tame or soften their natures; and while they continued in their cages, they still testified an unceasing disposition for slaughter. When their food was given them, the male always served himself before the female ventured to touch a bit; and it was not till he was satisfied that the other began. In their savage state, these animals are still more destructive; having great strength and agility, they very easily find and overtake their prey, which they pursue among the tops of the trees as well as on the ground; but what renders them still more mischievous is, their unceasing appetite rather for the blood than the flesh of their prey. They suck this with the greatest avidity, but frequently leave the carcass otherwise untouched, in order to pursue other animals for their blood in like manner. They generally continue on the tops of trees, like our wild cats, where they make their nest, and often bring forth their young. When they spy any animal they can master, and there are but few in the forest but what are inferior, they dart down upon it with inevitable exactness.

---

[1] The ocelot was known to the natives of South America by the name of *tlalocelotl*, from which, by abbreviation, we have derived a cognomen less difficult to pronounce, and which at the same time does not much differ from the original designation. In size the ocelot is about three feet in length and eighteen inches in height. The legs are long; ears somewhat broad, and sometimes tipped with a few hairs. Upon a grey ground are oblong, fawn-coloured patches of a dark colour, surrounded with a border perfectly black. At the top of the back there is a continuous dark line; and the tail is beautifully spotted. The under part of the body is white with spots of fawn which extend to the feet. The skin of the male ocelot exceeds that of the tiger in beauty and variety, and in brightness and regularity of the spots it is much superior to the leopard. In this respect the panther or the ounce cannot be compared to the ocelot, so that in appearance it is more elegant than those of its tribe which inhabit the Old world. In the female the colours of the skin are comparatively dull and the spots less regular.

The ocelot, like most animals of the cat tribe, is distinguished in its wild state by considerable ferocity, though specimens which have been brought to Europe have exhibited a subdued character. A male and female were brought to Paris in 1764 by M. Lescot, who had taken them when quite young. He states that, when they were three months old, they were not only sufficiently strong but also so ferocious as to kill a bitch under which they had been put and which had suckled them. At the same time the ocelot frequently displays great timidity. It rarely attacks man, and fears dogs, and, when pursued, seeks safety in flight, endeavouring to elude its assailants by mounting a tree.

The ocelot passes the day in its retreat, but at night it prowls about in quest of prey, and under cover of the darkness, it approaches human habitations and enters the farm-yard. It sometimes awaits the approach of its prey concealed amid the branches of a tree, and when they are sufficiently near it springs upon them with unerring aim. It sucks the blood of the animals which it destroys, and therefore commits greater ravages than if its appetite were appeased by feeding upon the flesh of the animals it killed.

In a state of captivity it does not lose much of its natural character. M. Lescot states that he was obliged to confine in a cage the two specimens which he brought over, and which had displayed their savage character at so early a period. He supplied them on the voyage with fresh meat, of which they ate seven or eight pounds a-day. Live cats were several times thrown in to them; but, after sucking the blood until death ensued, the ocelots refused to touch the flesh; neither would they eat meat which had been cooked. A specimen which was kept in the gardens of the Zoological Society was fed upon rabbits and birds, which form their principal food in a wild state. It was tolerably docile, and did not seize its food with the eagerness and violence which usually distinguish its tribe. The ocelot, like the jaguar, panther, leopard, tiger and lion only produces two of its kind at a birth.

The whole tribe of animals of the panther kind, with long tails, are chiefly inhabitants, as was said, of the torrid zone; but those of the short-tailed kind, and particularly the lynx, are principally found in the cold countries that are bordering on the pole. The lynx is chiefly to be met with in the north of Germany, Lithuania, Muscovy, Siberia, and in North America. Those of the new continent, however, are rather smaller than in Europe, as is the case with almost all their quadrupeds; they are somewhat whiter also, but in other respects there is scarcely any difference to be found among them.[1] This animal has been called by some *lupus cervarius*, or a creature compounded between a wolf and a stag; but for what reason, is hard to guess; it no way resembles either, in shape or in disposition. In its nature, it exactly resembles the cat, except that being bigger, and nearly two feet long, it is bolder and fiercer. Like the cat, it climbs trees, and seeks its prey by surprise; like the cat, it is delicate and cleanly, covering its urine with its paws; and it resembles the wolf in nothing except its cry, which often deceives the hunters, and induces them to think they hear a wolf and not a lynx. This animal also is rather more delicate than the cat; and after having once feasted upon its prey, will never return to it again, but hunts the woods for another. From hence may have arisen the common report of the lynx having, of all other quadrupeds, the shortest memory. This, however, is not the only idle story that has been propagated of it; as of its seeing with such perspicuity, as to perceive objects through the walls and mountains; as of having its urine of such a quality, as to harden and become a precious stone with several others propagated by ignorance or imposture.

The SIAGUSH and the SERVAL are both so like all the rest of the cat kind in disposition, that it is but repeating the same account once more to give their distinct history. As the lynx is found only in cold countries, so the siagush is to be met with only in the warm tropical climates. It is used, in the same manner as the ounce, for hunting; but it seems to have a property which the other has not: namely, that of being able to overtake its prey by pursuing it. Whether this is performed by having a finer scent than the former, or greater swiftness, we are not informed; being only told that when it overtakes either the gazelle or the antelope, it leaps upon their backs, and, getting forward to their shoulder, scratches their eyes out, by which means they become an easy prey to the hunters. Some have called this animal the *lion's provider;* and it is said, that when it calls him to pursue his prey, its voice very much resembles that of one man calling another.[2] From hence we may conjecture that this animal pursues its prey in full cry, and that the lion only follows to partake or seize the spoil. The same account is given also of the jackal; and very probably it may be true, not only of these animals, but of some others, since it is natural enough to suppose that the lion will pursue whenever he is taught to discover his prey.

We had one of these animals a few years ago sent over from the East Indies, but it was not able to endure the change of climate, and it died in a very short time after it was brought to the Tower. Whether consumed by disease or not, I cannot tell, but it seemed to me much slenderer than the cat or the lynx, and its ears were much longer; however, it is a very strong creature for its size, and has been known to kill a large dog in single combat; nevertheless, it is, like all of the cat kind, except the lion, remarkable for its cowardice, and will never, except in cases of necessity, attack an animal that is its equal in strength or activity. For this reason, when brought into the field, and put upon a service of danger, it obstinately refuses, and is alert only in the pursuit of animals that are too feeble for resistance, or are too timid to exert their strength.

From what has been said of this rapacious tribe, we perceive a similitude in the manners and dispositions of them all, from the lion to the cat. The similitude of their internal conformation is still more exact; the shortness of their intestines, the number of their teeth, and the structure of their paws. The first of this class is the lion, distinguishable from all the rest by his strength, his magnitude, and his mane. The second is the tiger, rather longer than the lion, but not so tall, and known by the streaks and the vivid beauty of its robe; including also the American tiger or cougar; distinguishable by its size, next to that of the tiger, its tawny colour, and its spots. The third is the panther and the leopard. The fourth is the ounce, not so large as any of the former, spotted like them, but distinguishable by the cream-coloured ground of its hair, and the great length of its tail, being above the length of its body. The fifth is the catamountain or tiger cat, less than the ounce, but differing particularly in having a shorter tail, and being streaked down the back like a tiger. The sixth is the short-tailed kind; namely, the lynx, of the size of the former, but with a short tail, streaked, and the tips of its ears tufted with black. The seventh is the siagush, differing from the lynx in not being mottled like it, in not being so large, and in having the ears longer, though tipped with black, as before. The eighth is the serval, resembling the lynx in its form, and the shortness of its tail; streaked also like it, but not having the tips of its ears tufted. Lastly, the cat, wild and tame, with all its varieties; all less than any of the former, but, like them, equally insidious, rapacious, and cruel.

---

[1] Buffon.

[2] Thevenot, vol. ii. 114.

This whole race may be considered as the most formidable enemy of mankind: there are others indeed stronger, but they are gentle, and never offer injury till injured; there are others more numerous, but they are more feeble, and rather look for safety by hiding from man, than opposing him. These are the only quadrupeds that make good their ground against him; and which may be said to keep some kingdoms of the earth in their own possession. How many extensive countries are there in Africa, where the wild beasts are so numerous, that man is deterred from living amongst them: reluctantly giving up to the lion and the leopard, extensive tracts, that seem formed only for his delight and convenience!

CHAP. II.

ANIMALS OF THE DOG KIND.

The second class of carnivorous quadrupeds may be denominated those of the *dog kind*. This class is neither so numerous nor so powerful as the former, and yet neither so treacherous, rapacious, or cowardly. This class may be principally distinguished by their claws, which have no sheath, like those of the cat kind, but still continue at the point of each toe, without a capability of being stretched forward, or drawn back. The nose also, as well as the jaw, of all the dog kind, is longer than in the cat; the body is, in proportion, more strongly made, and covered with hair instead of fur. There are many internal distinctions also; as in the intestines, which are much longer in the dog kind than in those of the cat; the eye is not formed for night vision; and the olfactory nerves are diffused, in the dog kinds, upon a very extensive membrane within the skull.

If we compare the natural habitudes of this class with the former, we shall find that the dog kinds are not so solitary as those of the cat, but love to hunt in company, and encourage each other with their mutual cries. In this manner the dog and the jackal pursue their prey; and the wolf and fox, which are of this kind, though more solitary and silent among us, yet, in countries where less persecuted, and where they can more fearlessly display their natural inclinations, they are found to keep together in packs, and pursue their game with alternate howlings.

Animals of the dog kind want some of the advantages of the cat kind, and yet are possessed of others in which the latter are deficient. Upon observing their claws, it will easily be perceived that they cannot, like cats, pursue their prey up the sides of a tree, and continue the chase among the branches; their unmanageable claws cannot stick in the bark, and thus support the body up along the trunk, as we see the cat very easily perform; whenever, therefore, their prey flies up a tree from them, they can only follow it with their eyes, or watch its motions till hunger again brings it to the ground. For this reason, the proper prey of the dog kind are only those animals that, like themselves, are unfitted for climbing; the hare, the rabbit, the gazelle, or the roe-buck.

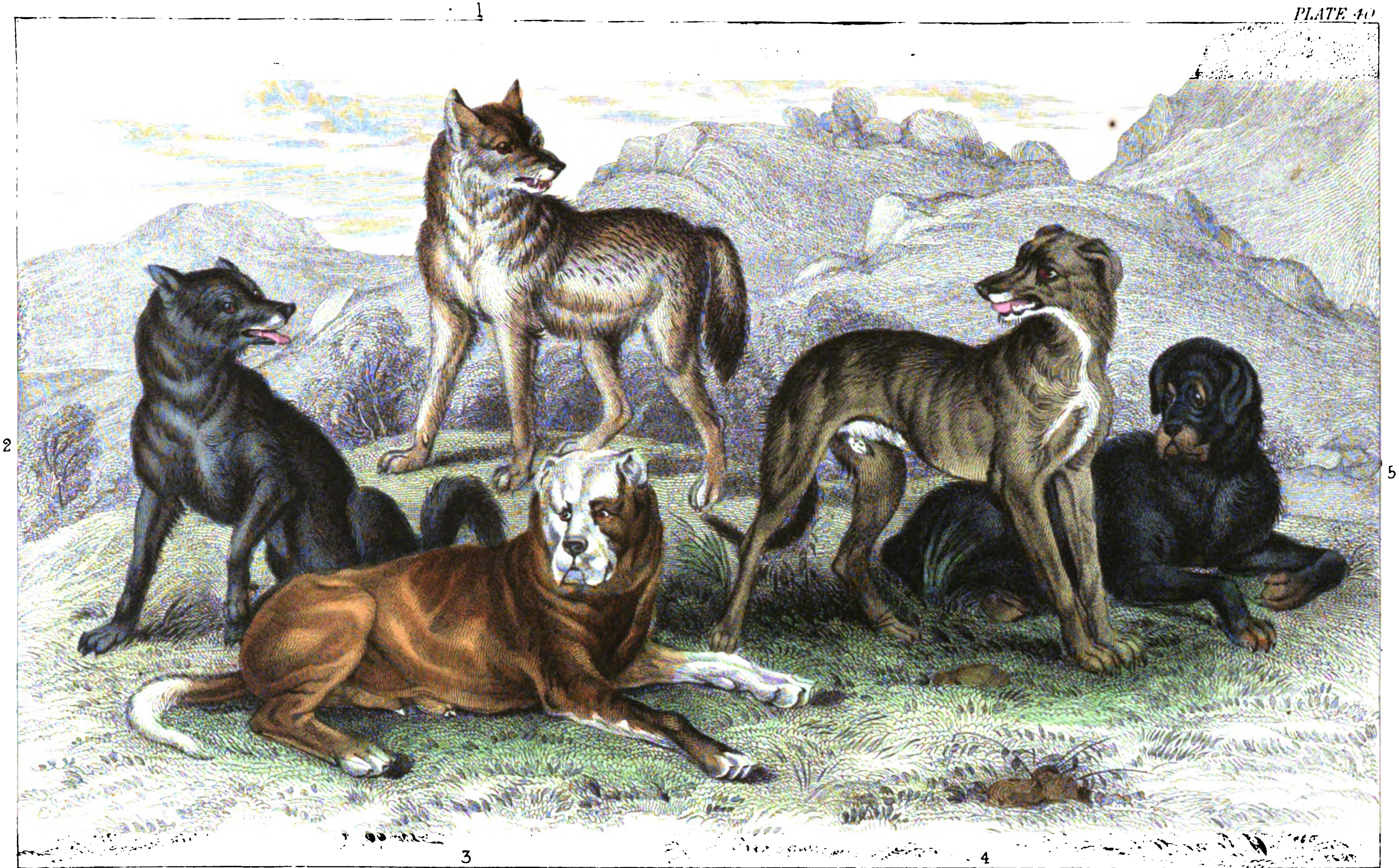
As they are, in this respect, inferior to the cat, so they exceed it in the sense of smelling, by which alone they pursue their prey with certainty of success, wind it through all its mazes, and tire it down by perseverance. It often happens, however, in the savage state, that their prey is either too much diminished, or too wary to serve for a sufficient supply. In this case, when driven to an extremity, all the dog kinds can live for some time upon fruits and vegetables, which, if they do not please the appetite, at least serve to appease their hunger.

Of all this tribe, the dog has every reason to claim the preference, being the most intelligent of all known quadrupeds, and the acknowledged friend of mankind. The dog,[1]

---

[1] The rest of this description of the dog is taken from Mr Buffon: what I have added, is marked as before.—*Note by Goldsmith.*

PLATE 40



James Stewart Del. John Miller Sc.

1. EUROPEAN WOLF 2. BLACK WOLF OF N. AMERICA 3. S^T BERNARD'S MASTIFF
4. HIGHLAND GREY HOUND 5. GREAT DOG OF NEPAUL

Blackie & Son Glasgow, Edinburgh & London

independent of the beauty of his form, his vivacity, force, and swiftness, is possessed of all those internal qualifications that can conciliate the affections of man, and make the tyrant a protector. A natural share of courage, an angry and ferocious disposition, renders the dog, in its savage state, a formidable enemy to all other animals: but these readily give way to very different qualities in the domestic dog, whose only ambition seems the desire to please: he is seen to come crouching along, to lay his force, his courage, and all his useful talents, at the feet of his master; he waits his orders, to which he pays implicit obedience; he consults his looks, and a single glance is sufficient to put him in motion; he is more faithful even than the most boasted among men; he is constant in his affections, friendly without interest, and grateful for the slightest favours; much more mindful of benefits received, than injuries offered, he is not driven off by unkindness; he still continues humble, submissive, and imploring; his only hope to be serviceable, his only terror to displease; he licks the hand that has been just lifted to strike him, and at last disarms resentment, by submissive perseverance.

More docile than man, more obedient than any other animal, he is not only instructed in a short time, but he also conforms to the dispositions and the manners of those who command him. He takes his tone from the house he inhabits; like the rest of the domestics, he is disdainful among the great, and churlish among clowns. Always assiduous in serving his master, and only a friend to his friends, he is indifferent to all the rest, and declares himself openly against such as seem to be dependent like himself. He knows a beggar by his clothes, by his voice, or his gestures, and forbids his approach. When at night the guard of the house is committed to his care, he seems proud of the charge; he continues a watchful sentinel, he goes his rounds, scents strangers at a distance, and gives them warning of his being upon duty. If they attempt to break in upon his territories, he becomes more fierce, flies at them, threatens, fights, and either conquers alone, or alarms those who have most interest in coming to his assistance; however, when he has conquered, he quietly reposes upon the spoil, and abstains from what he has deterred others from abusing; giving thus at once a lesson of courage, temperance, and fidelity.[1]

From hence we see of what importance this animal is to us in a state of nature. Supposing, for a moment, that the species had not existed, how could man, without the assistance of the dog, have been able to conquer, tame, and reduce to servitude, every other animal? How could he discover, chase, and destroy, those that were noxious to him? In order to be secure, and to become master of all animated nature, it was necessary for him to begin by making a friend of a part of them; to attach such of them to himself, by kindness and caresses, as seemed fittest for obedience and active pursuit. Thus the first art employed by man, was in conciliating the favour of the dog; and the fruits of this art were, the conquest and peaceable possession of the earth.

---

[1] Volumes might be filled with anecdotes of the sagacity and fidelity of the dog. We shall here content ourselves with giving two instances, from two popular modern writers. The anecdotes are curious, as they relate to what is generally considered to be the meanest and least intellectual variety of dog—the *poodle*.

An officer in the forty-fourth regiment, who had occasion, when in Paris, to pass one of the bridges across the Seine, had his boots, which had been previously well-polished, dirted by a poodle-dog rubbing against them. He, in consequence, went to a man who was stationed on the bridge, and had them cleaned. The same circumstance having occurred more than once, his curiosity was excited, and he watched the dog. He saw him roll himself in the mud of the river, and then watch for a person with well-polished boots, against which he contrived to rub himself. Finding that the shoe-black was the owner of the dog, he taxed him with the artifice; and after a little hesitation, he confessed that he had taught the dog the trick in order to procure customers for himself. The officer being much struck with the dog's sagacity, purchased him at a high price, and brought him to England. He kept him tied up in London some time, and then released him. The dog remained with him a day or two, and then made his escape. A fortnight afterwards he was found with his former master, pursuing his old trade on the bridge.—*Jesse's Gleanings in Natural History.*

I have a poodle whom I would make tutor to my son, if I had one. I sometimes use him towards my own education. Will not the following trait of his character amuse you? He conceived a strange fondness, an absolute passion, for a young kitten, which he carried about in his mouth for hours when he went out to walk; and whenever he came to a resting-place, he set her down with the greatest care and tenderness, and began to play with her. When he was fed, she always took the nicest pieces away from him, without his ever making the slightest opposition. The kitten died, and was buried in the garden. My poor poodle showed the deepest grief, would not touch food, and howled mournfully the whole night long. What was my astonishment, when the next morning he appeared carrying the kitten in his mouth! He had scratched her out of the ground, and it was only by force that we could take her from him.—*Prince Puckler Muska.*

The following extraordinary instance of the natural attachment of a terrier bitch may form a proper accompaniment to the affectionate conduct of Prince Puckler Muska's poodle. It is taken from a German magazine. —A celebrated preacher, named Bucholz, who resided at Hasmark in Hungary, had occasion to go to the village of Eperies, distant about twenty English miles from his own place of abode. He travelled on foot, and took with him a small terrier bitch, then in the last week of her pregnancy. After having been detained several days at Eperies by floods, he was compelled to return home without his dog, which in the mean time had brought forth a litter of five puppies. He had not been in the house an hour, when, to his surprise, the bitch came in bearing a puppy in her mouth, which she carefully placed upon the mat where she ordinarily lay, and immediately rushed out of the house again on the road to Eperies. In the space of twenty-four hours, she went and returned four times more; on each occasion bringing home a puppy in her mouth. It is hardly necessary to state that the puppies were quite dead as the mother brought them into the house. As the poor creature laid the last puppy upon the mat, she could scarcely stand for weariness; she whined and trembled, looking pitifully upon her dead puppies; and after walking once or twice round the mat, she laid herself down beside them, and died in a few minutes. In twenty-four hours the animal had run about 180 miles.

The generality of animals have greater agility, greater swiftness, and more formidable arms, from nature, than man; their senses, and particularly that of smelling, are far more perfect: the having gained, therefore, a new assistant, particularly one whose scent is so exquisite as that of the dog, was the gaining a new sense, a new faculty, which before was wanting. The machines and instruments which we have imagined for perfecting the rest of the senses, do not approach to that already prepared by nature, by which we are enabled to find out every animal, though unseen, and thus destroy the noxious, and use the serviceable.

The dog, thus useful in himself, taken into a participation of empire, exerts a degree of superiority over all animals that require human protection. The flock and the herd obey his voice more readily even than that of the shepherd or the herdsman; he conducts them, guards them, keeps them from capriciously seeking danger, and their enemies he considers as his own. Nor is he less useful in the pursuit; when the sound of the horn, or the voice of the huntsman, calls him to the field, he testifies his pleasure by every little art, and pursues with perseverance those animals, which, when taken, he must not expect to divide. The desire of hunting is indeed natural to him, as well as to his master, since war and the chase are the only employment of savages. All animals that live upon flesh hunt by nature; the lion and the tiger, whose force is so great that they are sure to conquer, hunt alone, and without art; the wolf, the fox, and the wild dog, hunt in packs, assist each other, and partake the spoil. But when education has perfected this talent in the domestic dog; when he has been taught by man to repress his ardour, to measure his motions, and not to exhaust his force by too sudden an exertion of it; he then hunts with method, and always with success.

"Although the wild dog, such as he was before he came under the protection of mankind, is at present utterly unknown, no such animal being now to be found in any part of the world, yet there are many that, from a domestic state, have turned savage, and entirely pursue the dictates of nature." In those deserted and uncultivated countries where the dog is found wild, they seem entirely to partake of the disposition of the wolf; they unite in large bodies, and attack the most formidable animals of the forest, the cougar, the panther, and the bison. In America, where they were originally brought by the Europeans, and abandoned by their masters, they have multiplied to such a degree, that they spread in packs over the whole country, attack all other animals, and even man himself does not pass without insult. They are there treated in the same manner as all other carnivorous animals, and killed wherever they happen to come: however, they are easily tamed; when taken home, and treated with kindness and lenity, they quickly become submissive and familiar, and continue faithfully attached to their masters. Different in this from the wolf or the fox, who, though taken never so young, are gentle only while cubs, and, as they grow older, give themselves up to their natural appetites of rapine and cruelty. In short, it may be asserted, that the dog is the only animal whose fidelity is unshaken; the only one who knows his master, and the friends of the family; the only one who instantly distinguishes a stranger; the only one who knows his name, and answers to the domestic call; the only one who seems to understand the nature of subordination, and seeks assistance; the only one who, when he misses his master, testifies his loss by his complaints; the only one who, carried to a distant place, can find the way home; the only one whose natural talents are evident, and whose education is always successful.

In the same manner, as the dog is of the most complying disposition, so also it is the most susceptible of change in its form; the varieties of this animal being too many for even the most careful describer to mention. The climate, the food, and the education, all make strong impressions upon the animal, and produce alterations in its shape, its colour, its hair, its size, and in every thing but its nature. The same dog, taken from one climate, and brought to another, seems to become another animal; but different breeds are as much separated, to all appearance, as any two animals the most distinct in nature. Nothing appears to continue constant with them, but their internal conformation; different in the figure of the body, in the length of the nose, in the shape of the head, in the length and the direction of the ears and tail, in the colour, the quality, and the quantity of the hair; in short, different in every thing but that make of the parts which serves to continue the species, and keep the animal distinct from all others. It is this peculiar conformation, this power of producing an animal that can reproduce, that marks the kind, and approximates forms that at first sight seem never made for conjunction.

From this single consideration, therefore, we may at once pronounce all dogs to be of one kind; but which of them is the original of all the rest, which of them is the savage dog from whence such a variety of descendants have come down, is no easy matter to determine. We may easily, indeed, observe, that all those animals which are under the influence of man, are subject to great variations. Such as have been sufficiently independent, so as to choose their own climate, their own nourishment, and to pursue their own habitudes, preserve the original marks of nature, without much deviation; and it is probable, that the first of these is even at this day very well represented in their descendants. But such as man has subdued, transported from one climate to another, controlled in their manner of living and their food, have most probably been changed also in their forms; particularly the dog has felt these alterations more strongly than any other of the domestic kinds; for living more like man he may be thus said to live more irregularly also, and consequently must have felt all those changes that such variety would naturally produce. Some other causes also may be assigned for this variety in the species of the dog: as he is perpetually under the eye of his master, when accident has produced any singularity in its productions man uses all his art to continue this peculiarity unchanged; either by breeding from such as had those singularities, or by destroying such as happened to want them; besides, as the dog produces much more frequently than some other animals, and lives a shorter time, so the chance for its varieties will be offered in greater proportion.

But which is the original animal, and which the artificial or accidental variety, is a question which, as was said, is not easily resolved.[1] If the internal structure of dogs of different sorts be compared with each other, it will be found, except in point of size, that in this respect they are exactly the same. This, therefore, affords no criterion. If other ani-

---

[1] Some have considered the dog as a domesticated wolf; others think it is a chacal; and many, observing that wild dogs are found always to have the ears erect, have, from this circumstance principally, concluded, that the shepherd's or wolf-dog is the original root. Since, however, the shape of the head has so much excited the attention of naturalists, it has been found that some dogs correspond more in this particular with the wild dogs than with any domesticated variety; and the dingo, or New Holland dog, a half reclaimed animal, and its like, are placed at the head of the list, as being supposed to be nearest to the wild and original stock. Thus M. Frederick Cuvier has arranged the varieties of the dog, upon this principle, into *three* groups, each differing materially in the shape of the head, and the length of the jaws and muzzle.

Without determining which of the known varieties is the most ancient, or deciding upon the claim of pureness of blood and descent to which each may pretend, we shall merely refer to the anatomical principles, which form the ground work of this arrangement.

The *first* of these, which includes the greyhounds and their consimilars, have the head more or less elongated; the parietal bones insensibly approaching each other; and the condyles of the lower jaw placed in a horizontal line with the upper cheek-teeth.

The *next* group of dogs includes much the most intelligent, interesting, and useful varieties. Their head and jaws are shorter than those proper to the first division, but they are not so completely truncated as in these of the third. To speak anatomically, the parietal bones do not approach each other above the temporal fossæ, but, on the contrary, they widen so as to enlarge the cerebral cavity and the forehead. The spaniels, hounds, shepherd's, and wolf-dogs, and the still more useful Siberian and Esquimaux races of this genus, are included under this description.

The *third* subdivision of the dogs has the muzzle more or less shortened; the frontal sinuses considerable; and the condyle of the lower jaw extending above the line of the upper cheek-teeth. The construction of the heads of these animals renders the capacity of the cranium smaller, when compared with the jaws and face, than in the preceding divisions.

The *first* division includes among others,

The *Dingo*, or *New Holland dog*, the head and elongated snout of which half-wild variety are like those of a fox In its other proportions it agrees with the shepherd's dog. It is about two feet six inches long, and about two feet high. The fur, composed both of silky and woolly hairs, is of a deep yellowish brown colour, lighter on the lower parts of the body. It is very voracious and fierce; and Mr Pennant mentions one that was brought to this country, which leaped on the back of an ass, and would have destroyed it in a short time, had not the animal been rescued. It is very active, and runs with the tail stretched horizontally, the head elevated, and the ears erect. The wild dogs in Van Dieman's Land are very numerous, and commonly associate in packs. They are extremely destructive to the sheep.

The *Dhole*, or wild dog of the East Indies, is made like the dingo, but the hairs of the tail are not bushy. It is of a uniform bright red colour, and is found in South Africa, and in various parts of the east, where it is named dhole.

The *South American* half-reclaimed variety is about the size of a spaniel. The head has much of the character of the last, but the hairs are longer, particularly on the tail. The back is brown gray; the spots on the flanks and legs are ochrey; and the ground colour is gray, lightest on the belly. This animal is very much like a wolf; and probably the same as is noticed by the early voyagers to America, who assert that the Indians tamed wolves.

The *North American dog* of the Indians is also a half-tamed breed, which differs materially from the South American race, though it corresponds, apparently to identity, with the dogs found in the Falkland Islands. It is said, indeed, that the Spaniards landed this breed of animals on these islands after the Falkland Island dispute with England, in order to make any attempt of our countrymen to settle there difficult or impossible.

Of the domesticated races belonging to this division, the most prominent are the following:

The *Albanian dog* has been noticed by historians, naturalists, and poets, ever since Europe first began to be raised into consequence and importance. A supernatumals be compared with the dog internally, the wolf and the fox will be found to have the most perfect resemblance; it is probable therefore, that the dog, which most resembles the wolf or the fox externally, is the original animal of its kind; for it is natural to suppose, that as the dog most nearly resembles them internally, so he may be near them in external resemblance also, except where art or accident has altered his form. This being supposed, if we look among the number of varieties to be found in the dog, we shall not find one so like the wolf or the fox as that which is called the *shepherd's dog*. This is that dog with long coarse hair on all parts except the nose, pricked ears, and a long nose; which is common enough among us, and receives his name from being principally used in guarding and attending on sheep. This seems to be the primitive animal of his kind; and we shall be the more confirmed in this opinion if we attend to the different characters

---

ral origin, and infallible powers, have been attributed to it. Diana is said to have presented Procris with a dog, which was always sure of its prey; together with a dart, which never missed its aim, and always returned to its owner. To the former the canine genealogists of antiquity attributed the origin of the celebrated race of the south-east of Europe, particularly Molossus and Sparta. The very fine breed of dogs, now found very plentifully in this corner of Europe, particularly in Albania, accords with the descriptions existing of its progenitors, indigenous in the same countries, and does not seem to have degenerated. They are as big as a mastiff; their thick fur is very long and silky, generally of different shades of brown; their tail is long and bushy; the legs seem more calculated for strength than excessive speed, being stouter and shorter than those of the greyhounds; their head and jaws are elongated, and the nose is pointed.

The *French Mâtin*, (*Canis Laniarius*. L.) The French writers seem to consider this variety or breed as the most important of the race, and as the progenitor of many others: the reason for which is not very apparent, unless it is, that a venial patriotism is apt to decide in favour of our own country, when certainty and truth are unattainable. Mr Pennant identifies it with the Irish greyhound (*Canis Graius Hibernicus* of Ray,) and there certainly seems every reason to conclude, that the Molossian or Albanian breed, the French Mâtin, and the Irish greyhound, possibly, also, the Danish dog, and the greyhound, and its varieties, are ramifications from each other. This variety has the head elongated, and the forehead flat: the ears are partly erect, but pendulous towards the tips. It is about three feet long, and two feet high; very muscular, but active. The colour is ordinarily a yellowish-fawn, with blackish, oblique, and parallel, but indistinct rays. It will attack the wolf or wild boar eagerly, but is more commonly used in France as a house or sheep-dog.

The *Irish greyhound* is much like the last, if not the same animal; but is said to attain a larger size and is sometimes seen four feet in height It is to this breed that the Irish owe the extirpation of wolves from their island, since which time the race has gradually disappeared, and is now become extremely rare.

The *great Danish dog* is presumed by Buffon, to be the Mâtin transported to a northern latitude. It is commonly white, marked all over with small round black spots; and is generally used as a stable-dog, and to accompany a carriage.

The *common greyhound* (*Canis Grajus*. L.) is familiar to every one, and is very remarkable for its elongated jaws and compressed head, as well as for its speed, which exceeds that of all other dogs. When we compare the greyhounds with other varieties, in reference to the form and proportion of the head, we perceive that it terminates the series of those whose forehead is flat, and muzzle elongated. This flatness of the forehead is produced by the obliteration of the frontal sinuses from those cavities which are formed at the base of the nose, and which, being immediately connected with the nasal cavities, and covered with the same membranes as they are, increase the sense of smell. This is ordinarily accompanied with an extraordinary slenderness and length of the legs, as well as a great contraction of the abdomen; phenomena, which, although not explained, are without exception. This obliteration of the frontal sinuses, in weakening the powers of smell of the greyhound, contribute, probably, to the development of their other senses, by the necessity induced of exercising them more exclusively. The sight and hearing of this variety are excellent, and although they are as domestic as any of the race, the conque of their ears is but semipendent; notwithstanding which, they have the faculty of elevating and moving them with as much facility as the unreclaimed races. They are destitute of the fifth toe found in the other varieties. The greyhound is but little susceptible of education; his intelligence is limited, and he seems to conceive with slowness and difficulty, while other varieties do so with facility. His sentiments, however, are very strong, and he is, more than any other, alive to caresses; indeed, his emotions, on being noticed, are so strong, if we may judge, at least, by the violent and irregular movements of the heart, that it seems difficult to believe how they can be borne. This want of intelligence, joined to high sensibility, however, seem to divest the greyhound of any exclusive affection; he has no personal attachment, but is alike delighted with all who notice him.

The *Scotch greyhound* has long, curling, stiffish hair, generally white, inclining to a reddish-brown tinge. It is also called the wiry-haired greyhound.

The *Russian greyhound* has also long and bushy hair. The tail forms a spiral curl.

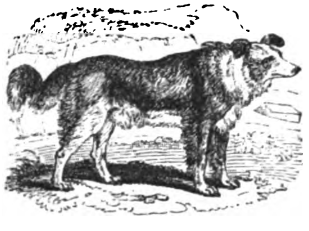
The *Italian greyhound*. The *Turkish greyhound*. These are small varieties of this group which are very timid, and seem to suffer much from the cold of this part of Europe. The former is either which climate produces in this animal, and the different races of dogs which are propagated in every country; and, in the first place, if we examine those countries which are still savage, or but half civilized, where it is most probable the dog, like his master, has received but few impressions from art, we shall find the shepherd's dog, or one very like him, still

---

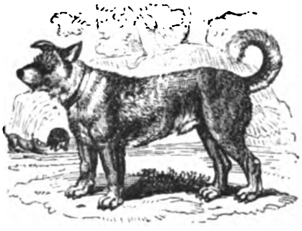
white or sable-coloured. The latter has the skin nearly naked.

The following varieties belong to the *second* group of M. F. Cuvier's arrangement.

The *shepherd's dog.* (*Canis Domesticus.* L.) This well-known animal is covered with long shaggy hair, and has little personal beauty to recommend it. The colour is, in general, varied black and gray. The ears, unlike those of most of the domesticated varieties, are short and erect; and the tail, which is bushy, is sometimes found directed horizontally, or even pendent, but more generally a little curved. The peculiar and eminently useful services of this variety to the shepherd, appear almost to arise from an intuitive disposition in the animal, rather than from laboured training; at least, there is an astonishing aptness exhibited by it in acquiring its lesson: with an apparent interest, patient perseverance, and courageous fidelity, accompanied by a discriminating sagacity in the performance of its task, when acquired, as notorious as it is surprising. This breed is confined to the temperate and southern parts of Europe; and in England there are two varieties of it: first, the shepherd's dog, properly speaking, or that which is the usual attendant on the flocks while in their pastures; and, secondly, that which may be called the drover's dog, which is larger than the former, and more usually employed to assist in driving sheep to the London market.



The *terrier.* Two distinct varieties are used for the purpose of entering the burrows of foxes, badgers, &c., in hunting, both of which are thence called terriers. The first is generally black on the back, sides, head, and tail; but has the belly, neck, paws, and tip of the tail, a bright or reddish-brown, with a spot of the like colour over each eye. The hair is short; the tail is carried slightly curved upwards; the ears are short and erect; and the snout is moderately elongated. Though small, it is a very resolute dog, and a determined enemy of rats, rabbits, and many other animals, in the pursuit of which it evinces an extraordinary and untaught alacrity. Some of them will draw a badger from his hole. The other species of the terrier alluded to, is generally of a dirty white colour, except about the eyes and ears, which are brown. It stands higher before than behind; has the muzzle more truncated than the other, and beset with stiff bristles; the hair, all over, is rather long and curly; and the ears are partly erect, and partly pendulous. This is, perhaps, in general, more powerful than the other. It is equally courageous, and quite as well fitted for the purposes from which they both take their name. It is sometimes called the Scotch terrier.



The *wolf, or Pomeranian dog,* (*Canis Pomeranus,* L.) has the hair short on the head, feet, and ears, but long and silky on the body and tail. It is white, black, gray, or yellowish in colour; and has almost all the sagacity of the shepherd's dog, accompanied with much more strength. It is also used as a guard for the flocks, particularly in countries pestered with the wolf, which it never fails to attack with success, while the former can only frighten that animal.

The *Siberian dog,* (*Canis Sibericus.* L.) appears to be nearly related to the last, and very like it, except that it is covered with long hair, even on the head and paws. Mr Pennant adds, that the other varieties in the inland parts of Russia and Siberia, are chiefly from the shepherd's dog; and there is a high-limbed, taper-bodied kind, the common dog of the Calmuc and independent Tartars, excellent for the chase, and all other uses. This breed is trained to the most important services in its cheerless native country, which appear to be very ill repaid, if the accounts we have of their treatment be correct. During the short Siberian summer, they are said to be turned adrift, to seek their own sustenance: and, at the commencement of winter, they are taken home for a series of fatiguing labour. Four of these dogs are attached, by pairs, to a sledge, and before them is placed a leader, on the good training of which much of the utility of the set seems to depend. These sledges carry but one person, who guides them principally by his voice, with the assistance of a stick, and of reins fastened to the collars of the dogs. It is said, they will thus draw a sledge between seventy and eighty miles in a day; and when the falling snow hides the beaten track from the sight of their master, they will keep or regain it by the power of their scent.

The *Esquimaux dog.* This highly useful breed is described by Mr Desmarest, as having the head shaped like that of the wolf-dog; the tail spreading and curved; and the ears erect. The hair is of two sorts; one silky, which is thinly scattered; the other woolly, which is extremely thick, very fine, and curly, and may be pulled off in flocks from the animal. The colour is black, or reddish-gray, with large marks of white. What the rein-deer is to the Laplander, this dog is to the Esquimaux. In the summer, a single dog carries a weight of thirty pounds, in attending his master in the pursuit of game: in winter, yoked in numbers to heavy sledges, they drag five or six persons at the rate of seven or eight miles an hour, and will perform journeys of sixty miles a day. In drawing the sledges, if the dogs scent a single rein-deer, even a quarter of a mile distant, they gallop off furiously in the direction of the scent; and the animal is soon within reach of the unerring arrow of the hunter. They will discover a seal-hole entirely by the smell, at a very great distance. Their desire to attack the ferocious bear is so great, that the word *nennook,* which signifies that animal, is often used to encourage them, when running in a sledge; two or three dogs, led forward by a man, will fasten upon the largest bear without hesitation. They are eager to chase every animal but the wolf; and of him they appear to have an instinctive terror which manifests itself on his approach in a loud and long-continued howl. Certainly there is no animal which combines so many properties useful to his master, prevailing amongst them. The dogs that have run wild in America, and in Congou, approach this form. The dog of Siberia, Lapland, and Iceland, of the Cape of Good Hope, of Madagascar, Madura, Calicut, and Malabar, have all a long nose, pricked ears, and resemble the shepherd's dog very nearly. In Guinea, the dog very speedily takes this form;

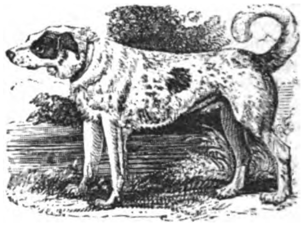
as the dog of the Esquimaux. The dogs of the Esquimaux lead always a fatiguing, and often a very painful life. In the summer they are fat and vigorous; for they have abundance of *kaow*, or the skin and part of the blubber of the walrus. But their feeding in winter is very precarious. Their masters have but little to spare; and the dogs become miserably thin, at a time when the severest labour is imposed upon them. It is not, therefore, surprising that the shouts and blows of their drivers have no effect in preventing them from rushing out of their road to pick up whatever they can descry; or that they are constantly creeping into the huts, to pilfer any thing within their reach: their chances of success are but small; for the people within the huts are equally keen in the protection of their stores, and they spend half their time in shouting out the names of the intruders (for the dogs have all names), and in driving them forth by the most unmerciful blows. The hunger which the Esquimaux dogs feel so severely in winter, is somewhat increased by the temperature they live in. In cold climates, and in temperate ones in cold weather, animal food is required in larger quantities than in warm weather, and in temperate regions. The only mode which the dogs have of assuaging or deceiving the calls of hunger, is by the distension of the stomach with any filth which they can find to swallow. The painful sense of hunger is generally regarded as the effect of the contraction of the stomach, which effect is constantly increased by a draught of cold liquid. Captain Parry mentions that in winter the Esquimaux dogs will not drink water, unless it happen to be oily. They know, by experience, that their cravings would be increased by this indulgence, and they lick some clean snow as a substitute, which produces a less contraction of the stomach than water.

The *spaniel*. (*Canis Extrarius*. L.) The spaniel has the hair very long, in parts. It is generally white, with large brown, liver-coloured, or black spots, of irregular shape and size. The nose is sometimes cleft. The ears are very long and pendulous, and covered with long hair. This race came originally from Spain, whence its name.

The *setter*. The setter is sometimes called the English spaniel. It corresponds in every point, with the true spaniel; but it is trained more immediately for field-sports.

The *Alpine spaniel*. The Alpine, or St Bernard's variety of the spaniel breed, exceeds all others in size and beauty. It generally reaches two feet in height at the shoulders, and full six feet from the nose to the end of the tail. There is a peculiarity about the corners of the eyes of this animal, which is attributed to the snow, and to the high windy regions it inhabits. Two of these dogs are sent out to scour the mountain, in search of lost or wearied travellers; one with a warm cloak fastened on his back, the other with a basket tied round his neck, containing a bottle of cordial. They are frequently of the most eminent use in meeting the traveller, in these snowy and dangerous regions, in time to lead him to the convent. It is said, that, in cases where a man has been found by them in an exhausted state, perishing with cold and fatigue, they will lie close to him, and afford warmth from their own bodies, to assist his resuscitation. A story is told of one of these dogs, who having found a child unhurt, whose mother had been destroyed by an avalanche, induced the poor boy to mount upon his back, and thus carried him to the convent.

The *Newfoundland dog*. This admired species is also highly useful in its native country and climate, where it is employed for many purposes of labour, particularly drawing wood on sledges to the sea-coast which they do without a driver, and return by themselves for more. Four of them are said to draw three hundred weight, on these sledges, a considerable distance. They are fitted by nature and inclination for the water, being semi-webbed between the toes, which greatly facilitates their swimming; and many instances are to be found of their saving persons from drowning. Their disposition is extremely docile, though their powers are great. The fine animal known to us by the name of Newfoundland dog is only half-bred, and of size inferior to the dog in its native state, when it measures about six feet and a half from the nose to the extremity of the tail, the length of which is two feet. In its own country it only barks when greatly irritated, and then with a manifestly painful effort, producing a sound which is described as particularly harsh. Its exemption from hydrophobia in Newfoundland appears to be well authenticated.



The wonderful sagacity of the Newfoundland dog is well known. The following instance, from the Sportsman's Annual, may be given, as one of very recent occurrence. A gentleman of Suffolk being on an excursion with his friend, and having a Newfoundland dog of the party, he soon became the subject of conversation; when the master, after a warm eulogium upon his perfections, assured his companion that he would, upon receiving the order, return, and fetch any article he should leave behind, from any distance. To confirm this assertion, a marked shilling was put under a large square stone by the side of the road—being first shown to the dog. The gentlemen then rode for three miles, when the dog received his signal from the master to return for the shilling he had seen put under the stone. The dog turned back, the gentlemen rode on and reached home, but, to their surprise and disappointment, the hitherto faithful messenger did not return during the day. It afterwards appeared that he had gone to the place where the shilling was deposited, but the stone being too large for his strength to remove, he had staid howling at the place, till two horsemen, riding by, and attracted by his seeming distress, stopped to look at him, when one of them alighting, removed the stone, and seeing the shilfor at the second or third generation the animal forgets to bark, his ears and his tail become pointed, and his hair drops off, while a coarser thinner kind comes in the place. This sort of dog is also to be found in the temperate climates in great abundance, particularly among those who, preferring usefulness to beauty, employ an animal that re-

---

ling, put it into his pocket, not at the time conceiving it to be the object of the dog's search. The dog followed their horses for twenty miles, remained undisturbed in the room where they supped, followed the chambermaid into the bedchamber, and secreted himself under one of the beds. The possessor of the shilling hung his trousers upon a nail by the bedside; but when the travellers were both asleep, the dog took them in his mouth, and, leaping out of the window, which was left open on account of the sultry heat, reached the house of his master at four o'clock in the morning, with the prize he had made free with; in the pocket of which were found a watch and money, that were returned upon being advertised, when the whole mystery was mutually unravelled, to the admiration of all the parties.

The *smaller spaniel, King Charles's dog,* (*Canis Brevipilis.* L.) is a small variety of the spaniel, prized as a fancy lap-dog in proportion to its diminutiveness. It is sometimes found entirely black, and is then called, in England, King Charles's dog, from the liking evinced by our second Charles for this variety.

The *Maltese dog.* The *lion dog,* (*Canis Leoninus.* L.) These, also, are small species of the spaniel. The first is supposed to have sprung from the intercourse of the little spaniel with the smaller water-dog. It has the hair, all over the body, extremely long and silky; and generally pure white. The other has long silky hair about the head, neck, shoulders, and extremity of the tail; but on the other parts it is short, giving the little animal a leonine appearance. It is probably bred between the little spaniel and one of the naked varieties.

The *great water-spaniel,* (*Canis Aquaticus,* L.) has long curly hair, and is, in other respects, much like the large land-spaniel; but the head is larger and rounder. The small water-spaniel is presumed to be the offspring of the great water-dog and the little spaniel. It is very much like the former animal; but the curly hair is more silky, and like that of the land-spaniel. There is also a useful variety of this breed between the water-spaniel and shepherd's dog. These animals are used as finders in shooting water-fowl, which their great fondness for water, and consequent aquatic habits, enable them to bring to the sportsman when the birds are shot, and have fallen into this element.

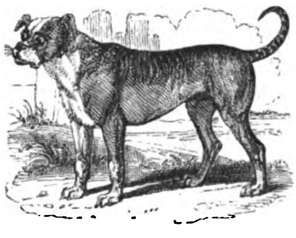
The *hound,* (*Canis Sagax.* L.) The hounds have the muzzle nearly as long as that of the dogs included in the first division, but much larger; their head is large and round; the ears are large, long, and pendulous; the limbs long and strong; the body is thick and long; the tail elevated; the hair uniformly short, and the colour is white, with large irregular, black, brown, or yellow patches. The largest variety of the hound used for stag-hunting, is also sometimes trained to follow the scent of blood, and is thence called the blood-hound. This variety was formerly much fostered in Great Britain; and was probably of particular use during the existence of the severe forest-laws. The king of Saxony kept a breed of hounds of immense size and powers, for boar-hunting. They were larger and taller than our largest mastiff, and had the transverse dark shades on the body which characterize this animal in general rather than the hound. The ground-colour was white, and the markings of a reddish or brownish yellow, in the different individuals. There is, as before stated, in the museum of Dresden, a dwarf dog, which attained two years of age. Major Smith observed, that this diminutive animal measured only five inches and a half in length, which was just the length, from the corner of the eye, to the tip of the nose, of a specimen of the Saxon boar-hounds he saw. The *fox-hound* is a smaller variety of the stag or blood-hound, used in fox-hunting. It is extremely persevering in the chase. The *harrier* is a still smaller variety of this species, used in hare-hunting. There are, again, particular breeds of the harrier, as the beagles and southern hounds, which rather interest the sportsman than the zoologist. The name of *Talbot* appears to have been applied to the several varieties of the hound.

The *pointer,* (see Plate XIII. fig. 57.) The muzzle of this variety is rather shorter and smaller than that of the hounds in general; the head is shorter; and the ears, which are smaller, are partly erect and partly pendulous. There is a large breed, called the Spanish pointer, which is considered as having greater acuteness of scent than the smaller or English pointer. The Dalmatian pointer is a beautiful spotted kind, which is white, with very small black or yellow spots. It is sometimes erroneously called the Danish dog.

The *turnspit,* (*Canis Vertagus.* L.) There are two varieties of the turnspit; one with the fore-legs crooked, the other with the legs straight. The head is like that of the pointer and hound.

The *third* subdivision of M. Frederic Cuvier includes the following varieties.

The *bull-dog,* (*Canis Molossus.* L.) The round, thick head, turned-up nose, and thick pendulous lips of this formidable dog, are familiar to all. The nostrils of this variety are frequently cleft. The want of that degree of discernment which is found in so many of the canine varieties, added to the ferocity of the bull-dog, make it extremely dangerous, when its courage and strength are employed to protect the person or property of its owner, or for any domestic purpose; since, unlike many of the more sagacious, though less powerful dogs, which seem rather more anxious to give the alarm, when danger threatens, by their barking, than to proceed immediately to action, the bull-dog, in general, makes a silent but furious attack; and the persisting powers of its teeth and jaws enable it to keep its hold against any but the greatest efforts, so that the utmost mischief is likely to ensue, as well to the innocent visitor of its domicile, as to the felonious intruder. The savage barbarity, which, in various shapes, is so apt to



quires very little instruction to be serviceable. Notwithstanding this creature's deformity, his melancholy and savage air, he is superior to all the rest of his kind in instinct; and without any teaching, naturally takes to tending flocks, with an assiduity and vigilance that at once astonishes and yet relieves his master.

In more polished and civilized places, the dog seems to partake of the universal refinement; and, like the men, becomes more beautiful, more majestic, and more capable of assuming an education foreign to his nature. The dogs of Albany, of Greece, of Denmark, and of Ireland, are larger and stronger than those of any other kind. In France, Germany, Spain, and Italy, the dogs are of various kinds, like the men; and this variety seems formed by crossing the breed of such as are imported from various climates.

The shepherd's dog may, therefore, be considered as the primitive stock from whence these varieties are all derived. He makes the stem of that genealogical tree which has been branched out into every part of the world. This animal still continues pretty nearly in its original state among the poor in temperate climates, being transported into the colder regions, he grows less and more ugly among the Laplanders; but becomes more perfect in Iceland, Russia, and Siberia, where the climate is less rigorous, and the people more civilized. Whatever differences there may be among the dogs of these countries, they are not very considerable, as they all have straight ears, long and thick hair, a savage aspect, and do not bark either so often or so loud as dogs of the more cultivated kind.

The shepherd's dog, transported into the temperate climates, and among people entirely civilized, such as England, France, and Germany, will be divested of his savage air, his pricked ears, his rough, long, and thick hair, and from the single influence of climate and food alone, will become either a matin, a mastiff, or a hound. Those three seem the immediate descendants of the former, and from them the other varieties are produced.

The **HOUND**, the **HARRIER**, and the **BEAGLE**, seem all of the same kind; for although the bitch is covered but by one of them, yet in her litters are found puppies resembling all the three. This animal, transported into Spain

---

show itself in the human mind, particularly when unchecked by education and refinement, has encouraged the breed of this variety of the dog, in order that gratification may be derived from the madness and torture of the bull and other animals, when exposed to the attacks of these furious beasts; and it is observed, that, since the decline of such sports, bull-dogs have diminished in number; an instance whence we may learn how much the efforts of mankind operate on the domesticated genera of the animal kingdom. The internal changes which determine the external characters of this dog, consist in a great developement of the frontal sinuses, a developement which elevates the bones of the forehead above the nose, and which leads in the same direction the cerebral cavity. But the most important change, and that, perhaps, which causes all the others, although we cannot perceive the connexion, is the diminution of the brain. The cerebral capacity of the bull-dog is sensibly smaller than in any other race, and it is, doubtless, to the decrease of the encephalon that we must attribute its inferiority to all others in every thing relating to intelligence. The bull-dog is scarcely capable of any education, and is fitted for nothing but combat and ferocity. A fifth toe is occasionally found more or less developed on the hind feet of this race. This, like all other races far removed from the primitive type, is difficult of reproduction; the males are seldom amorous, and the females frequently miscarry. Their life, also, is short, though their developement is slow: they scarcely acquire maturity under eighteen months, and at five or six years show signs of decrepitude. There is said to be a variety of the bull-dog found in Thibet, which is of a black colour.

The *pug-dog* may almost be called a diminutive variety of the bull-dog, to which it is nearly assimilated in appearance, though its tail is more curled. But this animal differs altogether in disposition from the bull-dog, being as timid as the other is courageous.

The *mastiff*, (*Canis Anglicus*. L.) This powerful breed is considered as English; it is said, however, to be bred between the Irish wolf-dog and the bull-dog, The ground-colour is generally a dirty white, with numerous dark hairs all over the body, and transverse stripes of a darker hue. It is a very large and powerful dog, and being much more capable of training, and not less courageous than the bull-dog, it is much fitter for domestic purposes. It is frequently known to protect its master's house and property by menaces only, even when a stranger is completely within its power; and will not be excited to violence, unless an imprudent perseverance should render it necessary for the protection of its charge; and, in such cases even, it has been known to pull a man down, and stand over without hurting him a considerable time, till its master appeared. This breed was assiduously fostered by the Romans, while they had possession of this island; and many of them were exported to Rome, to combat other animals in the amphitheatre. There is a degree of generosity about this animal, which commonly attends true courage; and, as if conscious of its superiority, the mastiff has been known to chastise with great dignity the impertinence of an inferior.—*Extracted, with additions, from Mr. Griffith's Supplement to the Animal Kingdom of Baron Cuvier.*

Two of the most remarkable varieties of the mastiff tribe are the *St. Bernard mastiff*, whose services to the bewildered traveller render him so valuable, and the *black dog of Nepaul*, or mastiff of Tibet, which is assumed to be the progenitor or type of the mastiff breed. (Pl. XL. figs. 3—5.)

or Barbary, where the hair of all quadrupeds becomes soft and long, will be there converted into the land-spaniel, and the water-spaniel, and these of different sizes.

The GRAY MATIN HOUND, which is the second branch, transported to the north, becomes the great Danish dog; and this sent to the south, becomes the greyhound of different sizes. The same transported into Ireland, the Ukraine, Tartary, Epirus, and Albania, becomes the great wolf-dog, known by the name of the Irish wolf-dog.

The MASTIFF, which is the third branch, and chiefly a native of England, when transported into Denmark, becomes the little Danish dog; sent into the tropical and warm climates, becomes the animal called the TURKISH DOG, without hair. All these races, with their varieties, are produced by the influence of climate, joined to the different food, education, and shelter which they have received among mankind. All other kinds may be considered as mongrel races, produced by the concurrence of these, and found rather by crossing the breed than by attending to the individual. " As these are extremely numerous and very different in different countries, it would be almost endless to mention the whole; besides, nothing but experience can ascertain the reality of these conjectures, although they have so much the appearance of probability; and until that gives more certain information, we must be excused from entering more minutely into the subject.

" With regard to the dogs of our country in particular, the varieties are very great, and the number every day increasing. And this must happen in a country so open by commerce to all others, and where wealth is apt to produce capricious predilection. Here the ugliest and the most useless of their kinds will be entertained merely for their singularity; and being imported only to be looked at, they will lose even that small degree of sagacity which they possessed in their natural climates. From this importation of foreign useless dogs, our town native breed is, I am informed, greatly degenerated, and the varieties now to be found in England much more numerous than they were in the times of queen Elizabeth, when Dr Caius attempted their natural history. Some of those he mentions are no longer to be found among us, although many have since been introduced, by no means so serviceable as those which have been suffered to decay.

He divides the whole race into three kinds. The first is, the generous kind, which consists of the terrier, the harrier, and the blood-hound; the gaze-hound, the grey-hound, the leymmer, and the tumbler; all these are used for hunting. Then the spaniel, the setter, and the water-spaniel, or finder, were used for fowling; and the spaniel gentle, or lap-dog, for amusement. The second is the farm kind; consisting of the shepherd's dog and the mastiff. And the third is the mongrel kind; consisting of the wappe, the turnspit, and the dancer. To these varieties we may add at present, the bull-dog, the Dutch mastiff, the harlequin, the pointer, and the Dane, with a variety of lap-dogs, which as they are perfectly useless, may be considered as unworthy of a name.

" The terrier is a small kind of hound,[1] with rough hair, made use of to force the fox or the badger out of their holes; or rather to give notice by their barking, in what part of their kennel the fox or badger resides, when the sportsmen intend to dig them out.

" The harrier, as well as the beagle and the fox-hound, are used for hunting; of all other animals they have the quickest and most distinguishing sense of smelling. The properly breeding, matching, and training these, make up the business of many men's lives.

" The blood-hound was a dog of great use, and in high esteem among our ancestors. Its employ was to recover any game that had escaped wounded from the hunter, or had been killed, and stolen out of the forest. But it was still more employed in hunting thieves and robbers by their footsteps. At that time, when the country was less peopled than at present, and when, consequently, the footsteps of one man were less crossed and obliterated by those of others, this animal was very serviceable in such pursuits; but at present, when the country is everywhere peopled, this variety is quite worn out; probably because it was found of less service than formerly.

" The gaze-hound hunted, like our grey-hounds, by the eye, and not by the scent. It chased indifferently the fox, hare, or buck. It would select from the herd the fattest and fairest deer, pursue it by the eye, and if lost recover it again with amazing sagacity. This species is now lost or unknown among us.

" The grey-hound is very well known at present, and was formerly held in such estimation, that it was the peculiar companion of a gentleman, who in the times of semi-barbarism, was known by his horse, his hawk, and his grey-hound. Persons under a certain rank of life are forbidden, by some late game-laws, from keeping this animal; wherefore, to disguise it the better, they cut off its tail.

" The leymmer is a species now unknown to us. It hunted both by scent and sight, and was led in a leyme, or thong, from whence it received its name.

The tumbler was less than the hound, more scraggy, and had pricked ears; so that by the description it seems to answer to the modern lurcher. This took its prey by mere cunning, depending neither on the goodness of its nose, nor its swiftness. If it came into a warren, it neither barked nor ran on the rabbits; but seemingly inattentive, approached sufficiently near till it came within reach, and then seized them by a sudden spring.

---

[1] British Zoology.

The land-spaniel, which probably had its name from Spain, where it might have acquired the softness of its hair, is well known at present. There are two varieties of this kind; namely, the slater, used in hawking to spring the game; and the setter, that crouches down when it scents the birds, till the net be drawn over them. I have read somewhere that the famous poet Lord Surry was the first who taught dogs to set, it being an amusement to this day only known in England.

"The water-spaniel was another species used in fowling. This seems to be the most docile of all the dog kind; and this docility is particularly owing to its natural attachment to man. Many other kinds will not bear correction; but this patient creature, though very fierce to strangers, seems unalterable in his affections; and blows and ill usage seem only to increase his regard.

"The lap-dog, at the time of Dr Caius, was of Maltese breed; at present it comes from different countries; in general the more awkward or extraordinary these are, the more they are prized.

"The shepherd's dog has been already mentioned, and as for the mastiff, he is too common to require a description. Dr Caius tells us, that three of these were reckoned a match for a bear, and four for a lion. However, we are told that three of them overcame a lion in the times of king James I. two of them being disabled in the combat, the third obliged the lion to seek for safety by flight.

"As to the last division, namely, of the wappe, the turnspit, and the dancer, these were mongrels, of no certain shape, and made use of only to alarm the family, or being taught a variety of tricks, were carried about as a show.

"With regard to those of later importation, the bull-dog, as Mr Buffon supposes, is a breed between the small Dane and the English mastiff. The large Dane is the tallest dog that is generally bred in England. It is somewhat between a mastiff and a greyhound in shape, being more slender than the one, and much stronger than the other. They are chiefly used rather for show than service, being neither good in the yard nor the field. The highest are most esteemed; and they generally cut off their ears to improve their figure, as some absurdly suppose. The harlequin is not so much unlike the small Dane, being a useless animal, somewhat between an Italian grey-hound and a Dutch mastiff. To these several others might be added, such as the pug dog, the black breed, and the pointer; but, in fact, the varieties are so numerous as to fatigue even the most ardent curiosity."

Of these of the foreign kinds, I shall mention only three, which are more remarkable than any of the rest. The lion-dog greatly resembles that animal, in miniature, from whence it takes the name. The hair of the fore part of the body is extremely long, while that of the hinder part is as short. The nose is short, the tail long, and tufted at the point, so that, in all these particulars, it is entirely like the lion. However, it differs very much from that fierce animal in nature and disposition, being one of the smallest animals of its kind, extremely feeble, timid, and inactive. It comes originally from Malta, where it is found so small that women carry it about in their sleeves.

That animal, falsely called the *Turkish dog*, differs greatly from all the rest of the kind, in being entirely without hair. The skin, which is perfectly bare, is of a flesh colour, with brown spots; and their figure, at first view, is rather disgusting. These seem to be of the small Danish breed, brought into a warm climate, and there, by a succession of generations, divested of their hair. For this reason, they are extremely chilly, and unable to endure the cold of our climate; and even in the midst of summer they continue to shiver as we see men in a frosty day. Their spots are brown, as was said, well-marked, and easily distinguishable in summer, but in the cold of winter they entirely disappear. They are called the Turkish breed, although brought from a much warmer climate; for some of them have been known to come from the warmest parts of Africa and the East Indies.

"The last variety, and the most wonderful of all that I shall mention, is the great Irish wolf-dog, that may be considered as the first of the canine species. This animal, which is very rare, even in the only country in the world where it is to be found, is rather kept for show than use, there being neither wolves nor any other formidable beasts of prey in Ireland, that seem to require so powerful an antagonist. The wolf-dog is therefore bred up in the houses of the great, or such gentlemen as choose to keep him as a curiosity, being neither good for hunting the hare, the fox nor the stag, and equally unserviceable as a house-dog. Nevertheless he is extremely beautiful and majestic to appearance, being the greatest of the dog kind to be seen in the world. The largest of those I have seen, and I have seen above a dozen, was about four feet high, or as tall as a calf of a year old. He was made extremely like a grey-hound.

but rather more robust, and inclining to the figure of the French matin, or the great Dane. His eye was mild, his colour white, and his nature seemed heavy and phlegmatic. This I ascribed to his having been bred up to a size beyond his nature; for we see in man, and all other animals, that such as are overgrown are neither so vigorous nor alert as those of moderate stature. The greatest pains have been taken with these to enlarge the breed, both by food and matching. This end was effectually obtained, indeed; for the size was enormous; but, as it seemed to me, at the expense of the animal's fierceness, vigilance, and sagacity.—However, I was informed otherwise; the gentleman who bred them assuring me, that a mastiff would be nothing when opposed to one of them, who generally seized their antagonist by the back; he added, that they would worry the strongest bull-dogs in a few minutes to death. But this strength did not appear either in their figure or their inclinations; they seemed rather more timid than the ordinary race of dogs; and their skin was much thinner, and consequently less fitted for combat. Whether with these disadvantages, they were capable, as I was told, of singly coping with bears, others may determine; however, they have but few opportunities, in their own country, of exerting their strength, as all wild carnivorous animals there are only of the vermin kind. Mr Buffon seems to be of opinion that these are the true Molossian dogs of the ancients; he gives no reason for this opinion; and I am apt to think it ill grounded. Not to trouble the reader with a tedious critical disquisition, which I have all along avoided, it will be sufficient to observe, that Nemesianus, in giving directions for the choice of a bitch, advises to have one of Spartan or Molossian breed; and, among several other perfections, he says that the ears should be dependent, and fluctuate as she runs.[1] This, however, is by no means the case with the Irish wolf-dog, whose ears resemble those of the grey-hound, and are far from fluctuating with the animal's motions. But of whatever kind these dogs may be, whether known among the ancients, or whether produced by a later mixture, they are now almost quite worn away, and are very rarely to be met with even in Ireland. If carried to other countries, they soon degenerate; and even at home, unless great care be taken, they quickly alter. They were once employed in clearing the island of wolves, which infested it in great plenty; but these being destroyed, the dogs also are wearing away, as if Nature meant to blot out the species, when they had no longer any services to perform.

"In this manner several kinds of animals fade from the face of Nature, that were once well known, but are now seen no longer. The enormous elk of the same kingdom, that, by its horns, could not have been less than eleven feet high, the wolf, and even the wolf dog, are extinct, or only continued in such a manner as to prove their former plenty and existence. From hence, it is probable, that many of the nobler kinds of dogs, of which the ancients have given us such beautiful descriptions, are now utterly unknown; since among the whole breed we have not one that will venture to engage the lion or the tiger in single combat. The English bull-dog is perhaps the bravest of the kind; but what are his most boasted exploits to those mentioned of the Epirotic dogs by Pliny, or the Indian dogs by Ælian? The latter gives us a description of a combat between a dog and a lion, which I will take leave to translate.

"When Alexander was pursuing his conquests in India, one of the principal men of that country was desirous of showing him the value of the dogs which his country produced. Bringing his dog into the king's presence, he ordered a stag to be let loose before him, which the dog despising as an unworthy enemy, remained quite regardless of the animal, and never once stirred from his place. His master then ordered a wild boar to be set out; but the dog thought even this a despicable foe, and remained calm and regardless as before. He was next tried with a bear; but still despising his enemy, he only waited for an object more worthy of his courage and his force. At last they brought forth a tremendous lion, and then the dog acknowledged his antagonist, and prepared for combat. He instantly discovered a degree of ungovernable ardour; and flying at the lion with fury, seized him by the throat, and totally disabled him from resistance. Upon this the Indian, who was desirous of surprising the king, and knowing the constancy and bravery of his dog, ordered his tail to be cut off: which was easily performed, as the bold animal was employed in holding the lion. He next ordered one of his legs to be broken; which, however, did not in the least abate the dog's ardour, but he still kept his hold as before. Another leg was then broken; but the dog, as if he had suffered no pain, only pressed the lion still the more. In this cruel manner, all his legs were cut off, without abating his courage; and at last, when even his head was separated from his body, the jaws seemed to keep their former hold. A sight so cruel did not fail to affect the king with very strong emotions, at once pitying the dog's fate, and admiring his fortitude. Upon which the Indian, seeing him thus moved, presented him with four dogs of the same kind, which, in some measure, alleviated his uneasiness for the loss of the former.

---

[1] Elige tunc cursu facilem, facilemque recursu,
In Lacedæmonio natam seu rure Molosso—
Renibus ampla satis validis diductaque coxis;
Cuique nimis molles fluitent in cursibus aures.
NEMESIAN.

"The breed of dogs, however, in that country, is at present very much inferior to what this story seems to imply; since, in many places, instead of dogs, they have animals of the cat kind for hunting. In other places, also, this admirable and faithful animal, instead of being applied to his natural uses, is only kept to be eaten. All over China there are dog-butchers, and shambles appointed for selling their flesh. In Canton, particularly, there is a street appointed for that purpose; and what is very extraordinary, wherever a dog-butcher appears, all the dogs of the place are sure to be in full cry after him; they know their enemy, and persecute him as far as they are able." Along the coasts of Guinea, their flesh is esteemed a delicacy by the Negroes; and they will give one of their cows for a dog. But, among this barbarous and brutal people, scarce any thing that has life comes amiss; and they may well take up with a dog, since they consider toads, lizards, and even the flesh of the tiger itself, as a dainty. It may, perhaps, happen that the flesh of this animal, which is so indifferent in the temperate climates, may assume a better quality in those which are more warm: but it is more than probable that the diversity is rather in man than in the flesh of the dog; since in the cold countries the flesh is eaten with equal appetite by the savages; and they have their dog-feasts in the same manner as we have ours for venison.

In our climate, the wild animals that most approach the dog are the wolf and the fox; these, in their internal conformation, greatly resemble each other, and yet in their natures are very distinct. The ancients asserted that they bred together; and I am assured, by credible persons, that there are many animals in this country bred between a dog and a fox. However, all the endeavours of Mr Buffon to make them engender, as he assures us, were ineffectual. For this purpose, he bred up a young wolf, taken in the woods, at two months old, with a matin dog of the same age. They were shut up together, without any other, in a large yard, where they had a shelter for retiring. They neither of them knew any other individual of their kind, nor even any other man, but he who had the charge of feeding them. In this manner they were kept for three years; still with the same attention, and without constraining or tying them up. During the first year the young animals played with each other continually, and seemed to love each other very much. In the second year, they began to dispute about their victuals, although they were given more than they could use. The quarrel always began on the wolf's side. They were brought their food, which consisted of flesh and bones, upon a large wooden platter, which was laid on the ground. Just as it was put down, the wolf, instead of falling to the meat, began by driving off the dog; and took the platter in its teeth so expertly, that it let nothing of what it contained fall upon the ground, and in this manner carried it off; but as the wolf could not entirely escape, it was frequently seen to run with the platter round the yard five or six times, still carrying it in a position that none of its contents could fall. In this manner it would continue running, only now and then stopping to take breath, until the dog coming up, the wolf would leave the victuals to attack him. The dog, however, was the stronger of the two, but as it was more gentle, in order to secure him from the wolf's attack, he had a collar put round his neck. In the third year, the quarrels of these ill-paired associates were more vehement, and their combats more frequent; the wolf, therefore, had a collar put about its neck, as well as the dog, who began to be more fierce and unmerciful. During the two first years, neither seemed to testify the least tendency towards engendering; and it was not till the end of the third, that the wolf, which was the female, showed the natural desire, but without abating either in its fierceness or obstinacy. This appetite rather increased than repressed their mutual animosity; they became every day more untractable and ferocious, and nothing was heard between them but the sounds of rage and resentment. They both, in less than three weeks, became remarkably lean, without ever approaching each other but to combat. At length, their quarrels became so desperate, that the dog killed the wolf, who was become more weak and feeble; and he was soon after himself obliged to be killed, for, upon being set at liberty, he instantly flew upon every animal he met, fowls, dogs, and even men themselves not escaping his savage fury.

The same experiment was tried upon foxes, taken young, but with no better success; they were never found to engender with dogs; and our learned naturalist seems to be of opinion that their natures are too opposite ever to provoke mutual desire. One thing, however, must be remarked, that the animals on which he tried his experiments, were rather too old when taken, and had partly acquired their natural savage appetites, before they came into his possession. The wolf, as he acknowledges, was two or three months old before it was caught, and the foxes were taken in traps. It may, therefore, be easily supposed, that nothing could ever after thoroughly tame those creatures that had been suckled in the wild state, and had caught all the habitudes of the dam. I have seen these animals, when taken earlier in the woods, become very tame; and indeed, they rather were displeasing by being too familiar than too shy. It were to be wished that the experiment were tried upon such as these; and it is more than probable that it would produce the desired success. Nevertheless, these experiments are sufficient to prove that neither the wolf nor the fox are of the same nature with the dog, but each of a species perfectly distinct, and their joint produce most probably unfruitful.

The dog, when first whelped, is not a completely finished animal. In this kind, as in all the rest which bring forth many at a time. the young are not so perfect as in those which bring forth but one or two. They are always produced with the eyes closed, the lids being held together, not by sticking, but by a kind of thin membrane, which is torn as soon as the upper eyelid becomes strong enough to raise it from the under. In general, their eyes are not opened till ten or twelve days old. During that time, the bones of the skull are not completed, the body is puffed up, the nose is short, and the whole form but ill sketched out. In less than a month the puppy begins to use all its senses; and from thence makes hasty advances to its perfection. At the fourth month, the dog loses some of his teeth, as in other animals, and these are renewed by such as never fall. The number of these amount to forty-two, which is twelve more than is found in any of the cat kind, which are known never to have above thirty. The teeth of the dog being his great and only weapon, are formed in a manner much more serviceable than those of the former; and there is scarce any quadruped that has a greater facility in rending, cutting, and chewing his food. He cuts with his incisors or fore teeth, he holds with his four great canine teeth, and he chews his meat with his grinders; these are fourteen in number, and so placed, that when the jaws are shut, there remains a distance between them, so that the dog by opening his mouth ever so wide, does not lose the power of his jaws. But it is otherwise in the cat kind, whose incisors, or cutting teeth, are very small, and whose grinding teeth, when brought together, touch more closely than those of the dog, and consequently have less power. Thus, for instance, I can squeeze any thing more forcibly between my thumb and fore-finger, where the distance is greater, than between any other two fingers, whose distance from each other is less.

This animal is capable of reproducing at the age of twelve months,[1] goes nine weeks with young, and lives to about the age of twelve years. Few quadrupeds are less delicate in their food, and yet there are many kinds of birds which the dog will not venture to touch. He is even known, although in a savage state, to abstain from injuring some, which one might suppose he had every reason to oppose. The dogs and the vultures which live wild about Grand Cairo in Egypt (for the Mahometan law has expelled this useful animal from human society) continue together in a very sociable and friendly manner.[2] As they are both useful in devouring such carcases as might otherwise putrefy, and thus infect the air, the inhabitants supply them with provisions every day, in order to keep them near the city. Upon these occasions the quadrupeds and birds are often seen together, tearing the same piece of flesh, without the least enmity; on the contrary, they are known to live together with a kind of affection, and bring up their young in the same nest.

Although the dog is a voracious animal, yet he can bear hunger for a very long time. We have an instance in the Memoirs of the Academy of Sciences, of this kind, in which a bitch that had been forgotten in a country-house, lived forty days without any other nourishment than the wool of a quilt which she had torn in pieces. It should seem that water is more necessary to the dog than food; he drinks often, though not abundantly; and it is commonly believed, that when abridged in water, he runs mad. This dreadful malady, the consequences of which are so well known, is the greatest inconvenience that results from the keeping of this faithful domestic. But it is a disorder by no means so frequent as the terrors of the timorous would suppose; the dog has been often accused of madness, without a fair trial; and some persons have been supposed to receive their deaths from his bite, when either their own ill-grounded fears, or their natural disorders, were the true cause.

---

[1] To this description I will beg leave to add a few particulars from Linnæus, as I find them in the original. —"Vomitua gramina purgatur; cacat supra lapidem. Album græcum antisepticum summum. Mingit ad latus (this, however, not till the animal is nine months old) cum hospite sæpe centies. Odorat anum alterius. Procis rixantibus crudelis menstruans coit cum variis. Mordet illa illos. Cohæret copula junctus."—*Note by Goldsmith.*

[2] Hasselquist Iter. Palestin. p. 232.

THE WOLF.

The dog and the wolf are so very much alike internally, that the most expert anatomists can scarcely perceive the difference; and it may be asserted also, that externally some dogs more nearly resemble the wolf than they do each other. It was this strong similitude that first led some naturalists to consider them as the same animal, and to look upon the wolf as the dog in its state of savage freedom: however, this opinion is entertained no longer; the natural antipathy those two animals bear to each other; the longer time which the wolf goes with young than the dog, the one going over a hundred days, and the other not quite sixty ;[1] the longer period of life in the former than the latter, the wolf living twenty years, the dog not fifteen; all sufficiently point out a distinction, and draw a line that must for ever keep them asunder.

The wolf, from the tip of the nose to the insertion of the tail, is about three feet seven inches long, and about two feet five inches high ; which shows him to be larger than our great breed of mastiffs, which are seldom found to be above three feet by two. His colour is a mixture of black, brown, and grey, extremely rough and hard, but mixed towards the roots with a kind of ash-coloured fur. In comparing him to any of our well-known breed of dogs, the great Dane or mongrel grey-hound for instance, he will appear to have the legs shorter, the head larger, the muzzle thicker, the eyes smaller, and more separated from each other, and the ears shorter and straighter. He appears in every respect stronger than the dog; and the length of his hair contributes still more to his robust appearance. The feature which principally distinguishes the visage of the wolf from that of the dog is the eye, which opens slantingly upwards in the same direction with the nose: whereas, in the dog, it opens more at right angles with the nose, as in man. The tail,

---

[1] This is a mistake. The female wolf has the same period of gestation as the female dog, namely sixty three days. The great resemblance between the wolf and the dog has been frequently remarked; and some naturalists consider them of the same species. The polar voyagers state, that they had often much difficulty to distinguish the dogs of the Esquimaux from the wolves; and yet, notwithstanding this external resemblance, there is a very essential difference in their characters, and the dog and the wolf are, in all circumstances, the natural foes of each other. Captain Parry, in the Journal of his Second Voyage, says, "A flock of thirteen wolves, the first yet seen, crossed the ice in the bay from the direction of the huts, and passed near the ships. They so much resemble the Esquimaux dogs, that, had it not been for some doubts among the officers who had seen them, whether they were so or not, and the consequent fear of doing these poor people an irreparable injury, we might have killed most of them the same evening, for they came boldly to look for food within a few yards of the Fury, and remained there for some time." Again, he says in his Journal, a few days after, "These animals were so hungry and fearless as to take away some of the Esquimaux dogs in a snow-house near the Hecla's stern, though the men were at the time within a few yards of them." These dogs set up a fearful howl at the approach of a wolf; and, in speaking of the resemblance between the two, it should be mentioned that wolves have not the bark of a dog, but only a howl; and, as the Esquimaux dog also does not bark, this, and the other circumstances of close resemblance, have led to the conclusion that this animal is no other than a domesticated wolf.

The wolf still continues to infest the northern regions of Europe, and those countries where dense forests are not yet cleared. It was extirpated much earlier in England than in any other country of Europe. Ancient chronicles state that, in the tenth century, king Edgar attempted to extirpate these animals in England by commuting the punishments for certain crimes into the acceptance of a certain number of wolves' tongues from each criminal; and, in Wales, by converting the tax of gold and silver into an annual tribute of three hundred wolves' heads. In after times their destruction was promoted by certain rewards, and some lands were held on condition of destroying the wolves which infested the parts of the kingdom in which they were situated. In 1281, these animals troubled several of the English counties, but after that period our records make no mention of them. The last wolf known in Scotland was killed in 1680, and in Ireland one was killed in 1701. Very fearful accounts are on record of the ravages committed by wolves, when in hard weather they associate in immense flocks. So lately as 1760 such terror is said to have been excited in France by the ravages of wolves, that public prayers were offered for their destruction. Thomson, in the fifth book of his "Winter," has thus powerfully described the ferocity of wolves :—

"By wintry famine rous'd from all the tract
Of horrid mountains which the shining Alps,
And wavy Apennine, and Pyrenees,
Branch out stupendous into distant lands,
Cruel as death, and hungry as the grave!
Burning for blood! bony, and gaunt, and grim!
Assembling wolves in raging troops descend,
And, pouring o'er the country, bear along,
Keen as the north wind sweeps the glossy snow.
All is their prize. They fasten on the steed,
Press him to earth, and pierce his mighty heart;
Nor can the bull his awful front defend,
Or shake the murdering savages away.
Rapacious, at the mother's throat they fly,
And tear the screaming infant from her breast.
The god-like face of Man avails him nought.
E'en beauty, force divine! at whose bright glance
The generous lion stands in softened gaze,
Here bleeds a hapless, undistinguished prey."

The following circumstance, showing the savage nature of the wolf, and interesting in more than one point of view, is related by Mr Lloyd, in his Field Sports of also, in this animal, is long and bushy; and he carries it rather more between his hind legs than the dog is seen to do. The colour of the eye-balls in the wolf are of a fiery green, and gives his visage a fierce and formidable air, which his natural disposition does by no means contradict.[1]

The wolf is one of those animals whose appetite for animal food is the most vehement; and whose means of satisfying this appetite are the most various. Nature has furnished him with strength, cunning, agility, and all those requisites which fit an animal for pursuing, overtaking, and conquering its prey; and yet, with all these, the wolf most frequently dies of hunger, for he is the declared enemy of man. Being long proscribed, and a reward offered for his head, he is obliged to fly from human habitations, and to live in the forest, where the few wild animals to be found there escape him either by their swiftness or their art; or are supplied in too small a proportion to satisfy his rapacity. He is naturally dull and cowardly, but frequently disappointed, and as often reduced to the verge of famine, he becomes ingenious from want, and courageous from necessity. When pressed with hunger, he braves danger, and comes to attack those animals which are under the protection of man, particularly such as he can readily carry away; lambs, sheep, or even dogs themselves, for all animal food becomes then equally agreeable. When this excursion has succeeded, he often returns to the charge, until having been wounded or hard pressed by the dogs or the shepherds, he hides himself by day in the thickest coverts, and only ventures out at night; he then sallies forth over the country, keeps peering round the villages, carries off such animals as are not under protection, attacks the sheepfolds, scratches up and undermines the thresholds of doors where they are housed, enters furious, and destroys all before he begins to fix upon and carry off his prey. When these sallies do not succeed, he then returns to the thickest part of the forest, content to pursue those smaller animals, which even when taken, afford him but a scanty supply. He there goes regularly to work, follows by the scent, opens to the view, still keeps following, hopeless himself of overtaking the prey, but expecting that some other wolf will come in to his assistance, and then

---

the North of Europe. It occurred in Russia some few years ago. A woman, accompanied by three of her children, were one day in a sledge, when they were pursued by a number of wolves. On this, she put the horse into a gallop, and drove towards her home, from which she was not far distant, with all possible speed. All, however, would not avail, for the ferocious animals gained upon her, and at last were on the point of rushing on the sledge. For the preservation of her own life and that of the remaining children, the poor frantic creature now took one of her babes and cast it a prey to her blood-thirsty pursuers. This stopped their career for a moment; but, after devouring the little innocent, they renewed the pursuit, and a second time came up with the vehicle. The mother, driven to desperation, resorted to the same horrible expedient, and threw her ferocious assailants another of her offspring. To cut short this melancholy story, her third child was sacrificed in a similar manner. Soon after this, the wretched being, whose feelings may more easily be conceived than described, reached her home in safety. Here she related what had happened, and endeavoured to palliate her own conduct, by describing the dreadful alternative to which she had been reduced. A peasant, however, who was among the bystanders, and heard the recital, took up an axe, and with one blow cleft her skull in two; saying, at the same time, that a mother who could thus sacrifice her children for the preservation of her own life, was no longer fit to live. This man was committed to prison, but the emperor subsequently gave him a pardon.

The wolf is generally considered untameable, but such is not the case. Indeed, no animal, however wild or rapacious, seems incapable of being subdued by early culture and kindness. M. F. Cuvier gives a very interesting account of a tame wolf which had all the obedience towards and affection for his master, which the most sagacious and gentle of domestic dogs could possibly evince. He was brought up in the same manner as a puppy, and continued with his original owner till he was full grown. He was then presented to the menagerie at Paris. For many weeks he was quite disconsolate at the separation from his master, who had been obliged to travel; he would scarcely take any food, and was indifferent to his keepers. At length he became attached to those about him, and he seemed to have forgotten his old affections. His master returned after an absence of eighteen months: the wolf heard his voice amidst the crowd in the gardens of the menagerie, and, being set at liberty, displayed the most violent joy. Again was he separated from his friend; and again was his grief as extreme as on the first occasion. After three years' absence, his master once more returned. It was evening, and the wolf's den was shut up from any external observation; yet the instant the man's voice was heard, the faithful animal set up the most anxious cries; and the door of his cage being opened, he rushed towards his friend,—leaped upon his shoulders,—licked his face,—and threatened to bite his keepers when they attempted to separate them. When the man left him, he fell sick, and refused all food; and from the time of his recovery, which was long very doubtful, it was always dangerous for a stranger to approach him. He appeared as if he scorned any new friendships. Among other instances of the affection which wolves had sometimes shown to their masters, M. de Candolle, lecturer on natural history at Geneva, mentioned one which took place in the vicinity of that city. A lady, Madame M———, had a tame wolf which seemed to have as much attachment to its mistress as a spaniel. She had occasion to leave home for some weeks: the wolf evinced the greatest distress after her departure, and at first refused to take food. During the whole time she was absent, he remained much dejected: on her return, as soon as the animal heard her footsteps, he bounded into the room in an ecstasy of delight; springing up, he placed one paw on each of her shoulders, but the next moment he fell backwards and instantly expired.

[1] The rest of this history of the wolf is taken from Mr Buffon; and I look upon it as a complete model for natural history. If I add or differ, I mark it as usual. —*Note by Goldsmith.*

content to share the spoil. At last, when his necessities are very urgent, he boldly faces certain destruction; he attacks women and children, and sometimes ventures even to fall upon men, becomes furious by his continual agitations, and ends his life in madness.

The wolf, as well externally as internally, so nearly resembles the dog, that he seems modelled upon the same plan; and yet he only offers the reverse of the medal. If his form be like, his nature is so different, that he only preserves the ill qualities of the dog, without any of his good ones. Indeed, they are so different in their dispositions, that no two animals can have a more perfect antipathy to each other. A young dog shudders at the sight of a wolf; he even shuns his scent, which, though unknown, is so repugnant to his nature that he comes trembling to take protection near his master. A dog who is stronger, and who knows his strength, bristles up at the sight, testifies his animosity, attacks him with courage, endeavours to put him to flight, and does all in his power to rid himself of a presence that is hateful to him. They never meet without either flying or fighting; fighting for life and death, and without mercy on either side. If the wolf is the stronger, he tears and devours his prey: the dog, on the contrary, is more generous, and contents himself with his victory; he does not seem to think that *the body of a dead enemy smells well;* he leaves him where he falls, to serve as food for birds of prey, or for other wolves, since they devour each other; and when one wolf happens to be desperately wounded, the rest track him by his blood, and are sure to show him no mercy.

The dog, even in his savage state, is not cruel; he is easily tamed, and continues firmly attached to his master. The wolf, when taken young, becomes tame, but never has an attachment. Nature is stronger in him than education; he resumes with age his natural dispositions, and returns as soon as he can to the woods from whence he was taken. Dogs, even of the dullest kinds, seek the company of other animals; they are naturally disposed to follow and accompany other creatures besides themselves; and even by instinct, without any education, take to the care of flocks and herds. The wolf, on the contrary, is the enemy of all society; he does not even keep much company with those of his kind. When they are seen in packs together, it is not to be considered as a peaceful society, but a combination for war; they testify their hostile intentions by their loud howlings, and, by their fierceness, discover a project for attacking some great animal, such as a stag or a bull, or to destroy some more redoubtable watch-dog. The instant their military expedition is completed, their society is at an end; they then part, and each returns in silence to his solitary retreat. There is not even any strong attachments between the male and the female; they seek each other only once a-year, and remain but a few days together; they always couple in winter; at which time several males are seen following one female, and this association is still more bloody than the former: they dispute most cruelly, growl, bark, fight, and tear each other; and it sometimes happens that the majority kill the wolf which has been chiefly preferred by the female. It is usual for the she-wolf to fly from them all with him she has chosen; and watches this opportunity when the rest are asleep.

The season for coupling does not continue above twelve or fifteen days; and usually commences among the oldest, those which are young being later in their desires. The males have no fixed time for engendering; they pass from one female to another, beginning at the end of December, and ending at the latter end of February. The time of pregnancy is about three months and a half;[1] and the young wolves are found from the latter end of April to the beginning of July. The long continuance of the wolf's pregnancy is sufficient to make a distinction between it and the dog, did not also the fiery fierceness of the eyes, the howl instead of barking, and the greater duration of its life, leave no doubt of its being an animal of its own particular species. In other respects, however, they are entirely alike; the wolf couples exactly like the dog, the parts are formed in the same manner, and their separation hindered by the same cause. When the she-wolves are near their time of bringing forth, they seek some very tufted spot, in the thickest part of the forest; in the middle of this they make a small opening, cutting away the thorns and briers with their teeth, and afterwards carry thither a great quantity of moss, which they form into a bed for their young ones. They generally bring forth five or six, and sometimes even to nine at a litter. The cubs are brought forth like those of the bitch, with the eyes closed; the dam suckles them for some weeks, and teaches them betimes to eat flesh, which she prepares for them by chewing it first herself. Some time after she brings them stronger food, hares, partridges, and birds yet alive. The young wolves begin by playing with them, and end by killing them. The dam then strips them of their feathers, tears them in pieces, and gives to each of them a share. They do not leave the den where they have been littered, till they are six weeks or two months old.

---

[1] The time of pregnancy, as we have already stated is only sixty-three days.

They then follow the old one, who leads them to drink to the trunk of some old tree, where the water has settled, or at some pool in the neighbourhood. If she apprehends any danger, she instantly conceals them in the first convenient place, or brings them back to their former retreat. In this manner they follow her for some months: when they are attacked, she defends them with all her strength, and more than usual ferocity. Although, at other times, more timorous than the male, at that season she becomes bold and fearless; willing perhaps to teach the young ones future courage by her own example. It is not till they are about ten or twelve months old, and until they have shed their first teeth, and completed the new, that she thinks them in a capacity to shift for themselves. Then, when they have acquired arms from Nature, and have learned industry and courage from her example, she declines all future care of them, being again engaged in bringing up a new progeny.

The males and females are in a capacity to engender when two years old. It is probable that the females of this species, as well as of most others, are sooner completed than the males; but this is certain, that they never desire to copulate until their second winter; from whence we may suppose that they live fifteen or twenty years; for allowing three years for their complete growth, this multiplied by seven, gives them a life of twenty-one; most animals, as has been observed, living about seven times the number of years which they take to come to perfection. Of this, however, there is as yet no certainty, no more than of what huntsmen assert, that in all the litters there are more males than females. From them also we learn, that there are some of the males who attach themselves to the female, who accompany her during her gestation, until the time of bringing forth, when she hides the place of her retreat from the male, least he should devour her cubs. But after this, when they are brought forth, that he then takes the same care of them as the female, carries them provisions, and, if the dam should happen to be killed, he rears them up in her stead.

The wolf grows gray as he grows old, and his teeth wear, like those of most other animals, by using. He sleeps when his belly is full, or when he is fatigued, rather by day than night; and always, like the dog, is very easily waked. He drinks frequently; and in times of drought, when there is no water to be found in the trunks of old trees, or in the pools about the forest, he comes often, in the day, down to the brooks or the lakes in the plain. Although very voracious, he supports hunger for a long time, and often lives four or five days without food, provided he be supplied with water.

The wolf has great strength, particularly in his fore parts, in the muscles of his neck and jaws. He carries off a sheep in his mouth without letting it touch the ground, and runs with it much swifter than the shepherds who pursue him; so that nothing but the dogs can overtake, and oblige him to quit his prey. He bites cruelly, and always with greater vehemence in proportion as he is least resisted; for he uses precautions with such animals as attempt to stand upon the defensive. He is ever cowardly, and never fights but when under the necessity of satisfying hunger, or making good his retreat. When he is wounded by a bullet, he is heard to cry out; and yet, when surrounded by the peasants, and attacked with clubs, he never howls as a dog under correction, but defends himself in silence, and dies as hard as he lived.

His nature is, in fact, more savage than that of the dog; he has less sensibility, and greater strength. He travels, runs, and keeps plundering for whole days and nights together. He is in a manner indefatigable; and perhaps of all animals he is the most difficult to be hunted down. The dog is good-natured and courageous; the wolf, though savage, is ever fearful. If he happens to be caught in a pit-fall, he is for some time so frightened and astonished, that he may be killed without offering to resist, or taken alive without much danger. At that instant, one may clap a collar round his neck, muzzle him, and drag him along, without his ever giving the least signs of anger or resentment. At all other times he has his senses in great perfection; his eye, his ear, and particularly his sense of smelling, which is even superior to the two former. He smells a carcase at more than a league's distance; he also perceives living animals a great way off, and follows them a long time upon the scent. Whenever he leaves the wood, he always takes care to go out against the wind. When just come to its extremity, he stops to examine, by his smell, on all sides, the emanations that may come either from his enemy or his prey, which he very nicely distinguishes. He prefers those animals which he kills himself to those he finds dead; and yet he does not disdain these when no better is to be had. He is particularly fond of human flesh; and perhaps, if he were sufficiently powerful, he would eat no other. Wolves have been seen following armies, and arriving in numbers upon the field of battle, where they devoured such dead bodies as were left upon the field, or but negligently interred. These, when once accustomed to human flesh, ever after seek particularly to attack mankind, and choose to fall upon the shepherd rather than his flock. We have had a late instance of two or three of these keeping a whole province, for more than a month, in a continual alarm.

It sometimes happens that a whole country is called out to extirpate these most dangerous invaders. The hunting the wolf is a favourite diversion among the great of some countries; and it must be confessed it seems to be the most useful of any. These animals are distinguished by the huntsman into the *young wolf*, the *old wolf*, and the *great wolf*. They are known by the prints of their feet; the older the wolf, the larger the track he leaves. That of the female is narrower and longer than that of the male. It is necessary to have a very good starter to put up the wolf; and it is even convenient to use every art to encourage him in his pursuit; for all dogs have a natural repugnance against this animal, and are but cold in their endeavours. When the wolf is once put up, it is then proper to have greyhounds to let fly at him, in leashes, one after the other. The first leash is sent after him in the beginning, seconded by a man on horseback; the second is let loose about half a mile farther, and the third when the rest of the dogs come up with and begin to bait him. He for a long time keeps them off, stands his ground, threatens them on all sides, and often gets away; but usually the hunters arriving, come in aid of the dogs, and help to despatch him with their cutlasses. When the animal is killed, the dogs testify no appetite to enjoy their victory, but leave him where he falls, a frightful spectacle, and even in death hideous.

The wolf is sometimes also hunted with harriers; but as he always goes straight forward, and often holds his speed for a whole day together, this kind of chase is tedious and disagreeable, at least if the harriers are not assisted by greyhounds, who may harass him at every view. Several other arts have also been used to take and destroy this noxious animal. He is surrounded and wounded by men and large house-dogs; he is secured in traps; he is poisoned by carcases prepared and placed for that purpose; and is caught in pitfalls. "Gesner tells us of a friar, a woman, and a wolf, being taken in one of these, all in the same night. The woman lost her senses by the fright, the friar his reputation, and the wolf his life." All these disasters, however, do not prevent this animal's multiplying in great numbers, particularly in countries where the woods are plenty. France, Spain, and Italy, are greatly infested with them; but England, Ireland, and Scotland, are happily set free.

King Edgar is said to be the first who attempted to rid this kingdom of such disagreeable inmates, by commuting the punishment for certain crimes into the acceptance of a number of wolves' tongues from each criminal.[1] However, some centuries after, these animals were again increased to such a degree as to become the object of royal attention; accordingly Edward the First issued out his mandate to one Peter Corbet to superintend and assist in the destruction of them. They are said to have infested Ireland long after they were extirpated in England; however, the oldest men in that country remember nothing of these animals; and it is probable that there have been none there for more than a century past. Scotland also is totally free.

The colour of this animal differs according to the different climates where it is bred, and often changes even in the same country. Besides the common wolves, which are found in France and Germany, there are others with thicker hair, inclining to yellow. These are more savage and less noxious than the former, neither approaching the flocks nor habitations, and living rather by the chase than rapine. In the northern climates there are found some quite black, and some white all over. The former are larger and stronger than those of any other kinds.

The species is very much diffused in every part of the world, being found in Asia, Africa, and in America, as well as in Europe. The wolves of Senegal resemble those of France, except that they are larger and much fiercer than those of Europe. Those of Egypt are smaller than those of Greece. In the East, the wolf is trained up for a show, being taught to dance and play tricks; and one of these thus educated often sells for four or five hundred crowns. "It is said that in Lapland the wolf will never attack a rein-deer that is seen haltered; for this wary animal, being well acquainted with the nature of a trap, suspects one wherever it perceives a rope. However, when he sees the deer entirely at liberty, he seldom fails to destroy it.

"The wolf of North America is blacker and much less than those in other parts of the world, and approaches nearer in form to the dog than those of the ordinary kind.[2] In fact, they were made use of as such by the savages, till the Europeans introduced others; and even now, on the remoter shores, or the more inland parts of the country, the savages still make use of these animals in hunting. They are very tame and gentle; and those of this kind that are wild are neither so large nor so fierce as an European wolf, nor do they ever attack mankind. They go together in large packs by night to hunt the deer, which they do as well as any dogs in England; and it is confidently asserted that one of them is sufficient to run down a deer.[1] Whenever they are seen along the banks of those rivers near which the wandering natives pitch their huts, it is taken for granted that the bison or the deer are not far off; and the savages affirm that the wolves come with the tidings, in order to have the garbage, after the animal has been killed by the hunters. Catesby adds a circumstance relative to these animals, which, if true, invalidates many of Mr Buffon's observations in the foregoing history. He asserts, that these being the only dogs used by the Americans, before the arrival of the Europeans among them, they have since engendered together, and that their breed has become prolific; which proves the dog and the wolf to be of the same species. It were to be wished that this fact were better ascertained; we should then know to a certainty in what degree the dog and wolf resemble each other, as well in nature as in conformation; we might then, perhaps, be enabled to improve the breed of our dogs, by bringing them back to their native forms and instincts: we might, by crossing the strain, restore that race of those bold animals, which the ancients assure us were more than a match for the lion."

---

[1] British Zoology, p. 62.

[2] Brooke's Natural History, vol. i. p. 198.

However this animal may be useful in North America, the wolf of Europe is a very noxious animal, and scarcely any thing belonging to him is good, except his skin. Of this the furriers make a covering that is warm and durable, though coarse and unsightly. His flesh is very indifferent, and seems to be disliked by all other animals, no other creature being known to eat the wolf's flesh except the wolf himself. He breathes a most fœtid vapour from his jaws, as his food is indiscriminate, often putrid, and seldom cleanly. In short, every way offensive, a savage aspect, a frightful howl, an insupportable odour, a perverse disposition, fierce habits, he is hateful while living, and useless when dead.

THE FOX.

The fox very exactly resembles the wolf and the dog internally; and although he differs greatly from both in size and carriage, yet when we come to examine their shapes minutely, there will appear to be very little difference in the description.[2] Were, for instance, a painter to draw from a natural historian's exactest description the figure of a dog, a wolf, and a fox, without having ever seen either, he would be very apt to confound all these animals together; or rather he would be unable to catch those peculiar outlines that no description can supply. Words will never give any person an exact idea of forms any way irregular; for although they be extremely just and precise, yet the numberless discriminations to be attended to will confound each other, and we shall no more conceive the precise form, than we should be able to tell when one pebble more was added or taken away from a thousand. To conceive, therefore, how the fox differs in form from the wolf or the dog, it is necessary to see all three, or at least to supply the defects of description by examining the difference in a print.

---

[1] Dictionaire Raisonnée, Loup.

[2] The fox inhabits almost every temperate country in the world, and in each he is distinguished for craftiness of character. There is great diversity of opinion respecting the different varieties of foxes; some considering them simply as varieties, changed and modified in their form from local circumstances, while others rank them as distinct species. These differences, however, are not so conspicuous as in the great varieties of the common dog.

Of the distinctive properties between the fox and dog, the most striking is in the structure of the eye. In dogs, the iris uniformly contracts around the pupil, in the form of a circle; while, in the fox, if observed under the influence of a strong light, it is seen to close in a vertical direction, the pupil assuming the figure of a section of a double convex lens. The object of this provision is obviously to exclude the rays of light. Much of the cunning suspiciousness of manner for which the fox is notorious, may be attributed to this circumstance: his attitudes and motions partake of the uncertainty of his sight, and he appears to be most cunning, when in reality he is most short-sighted.

The fox is of a wild and ferocious disposition, so much so, that it is hardly possible to render him wholly tame. He feeds indiscriminately on lambs, geese, fowls, hares, rabbits, and small birds of all kinds: his fondness for grapes renders him a great annoyance to the vineyards of France. The fox seldom fails to establish his habitation near some farm or village, so that he may the more easily attack the poultry, which appear to be his favourite food; and he often commits great depredations in poultry-yards, destroying in a single evening every thing that has life. When all other kinds of food fail him, he will destroy serpents, lizards, toads, moles, frogs, rats, and mice; and when extremely pressed by hunger, like the dog he will feed on roots and other vegetable substances; but this is only in cases of extreme necessity: he is also known to eat crabs, shrimps, or other shell-fish. The fox sometimes runs down his prey, and at others he slips cautiously forward, like a cat, dragging his body on the ground, and then makes a sudden bound at his booty, seldom missing his aim. He either conceals it among bushes or herbage, or carries it off to his burrow. In this manner, he returns repeatedly to his work of destruction, and generally keeps a considerable supply of provisions in store, but always in different places, to serve him under his various necessities; but it is seldom he prolongs these excursions after sunrise.

Fox-hunting has long been a favourite British field-sport, and in no other country is it pursued with such ardour and intrepidity. Both our dogs and horses are bred with particular care for this pastime, and are justly prized by all neighbouring states. The instant the fox finds himself pursued, he makes for his hole; but when it is intended to hunt a district, the huntsman or earth-stopper takes care to fill up the entrance to his burrow when he is out in search of food, so that he can only have recourse to his speed and cunning for his safety. He does not double, like the hare, but takes a straightforward course with strength and perseverance, and sometimes leads his pursuers a distance of fifty miles at a stretch, without the smallest intermission. Both dogs and horses, particularly the latter, frequently fall victims in such arduous chases. His strength is so great that he frequently escapes the utmost efforts of his enemies to take him, and returns to his hole in safety. But when all shifts have failed him, and he is at last overtaken, he defends himself with great obstinacy, and silently fights till he is literally torn to pieces by the merciless dogs.

The fox is of a slenderer make than the wolf, and not near so large; for as the former is above three feet and a half long, so the other is not above two feet three inches. The tail of the fox also is longer in proportion, and more bushy; its nose is smaller, and approaching more nearly to that of the greyhound, and its hair softer. On the other hand, it differs from the dog in having its eyes obliquely situated, like those of the wolf; its ears are directed also in the same manner as those of the wolf, and its head is equally large in proportion to its size. It differs still more from the dog in its strong offensive smell, which is peculiar to the species, and often the cause of their death. However, some are ignorantly of opinion that it will keep off infectious diseases, and they preserve this animal near their habitations for that very purpose.

The fox has since the beginning been famous for his cunning and his arts, and he partly merits his reputation.[1] Without attempting to oppose either the dogs or the shepherds, without attacking the flock, or alarming the village, he finds an easier way to subsist, and gains by his address what is denied to his strength or courage. Patient and prudent, he waits the opportunity for depredation, and varies his conduct with every occasion. His whole study is his preservation; although nearly as indefatigable, and actually more swift than the wolf, he does not entirely trust to either, but makes himself an asylum, to which he retires in case of necessity; where he shelters himself from danger, and brings up his young.

As among men, those who lead a domestic life are more civilized and more endued with wisdom than those who wander from place to place; so in the inferior ranks of animated nature, the taking possession of a home supposes a degree of instinct which others are without.[2] The choice of the situation for this domicile, the art of making it convenient, of hiding its entrance, and securing it against more powerful animals, are all so many marks of superior skill and industry. The fox is furnished with both, and turns them to his advantage. He generally keeps his kennel at the edge of the wood, and yet within an easy journey of some neighbouring cottage. From thence he listens to the crowing of the cock, and the cackling of the domestic fowls. He scents them at a distance; he seizes his opportunity, conceals his approaches, creeps slyly along, makes the attack, and seldom returns without his booty. If he be able to get into the yard, he begins by levelling all the poultry without remorse; and carrying off a part of the spoil, hides it at some convenient distance, and again returns to the charge. Taking off another fowl in the same manner, he hides that also, but not in the same place; and this he practises for several times together, until the approach of day, or the noise of the domestics, give him warning to retire. The same arts are practised when he finds birds entangled in springs laid for them by the fowler; the fox takes care to be beforehand, very expertly takes the bird out of the snare, hides it for three or four days, and knows very exactly when and where to return to avail himself of the hidden treasure. He is equally alert in seizing the young hares and rabbits before they have strength enough to escape him; and when the old ones are wounded and fatigued, he is sure to come upon them in their moments of distress, and to show them no mercy. In the same manner he finds out birds' nests, seizes the partridge and the quail while sitting, and destroys a large quantity of game. The wolf is most hurtful to the peasant, but the fox to the gentleman. In short, nothing that can be eaten seems to come amiss; rats, mice, serpents, toads, and lizards. He will, when urged by hunger, eat vegetables and insects; and those that live near the sea-coasts will, for want of other food, eat crabs, shrimps, and shell-fish. The hedge-hog in vain rolls itself up into a ball to oppose him: this determined glutton teases it until it is obliged to appear uncovered, and then he devours it. The wasp and the wild-bee are attacked with equal success. Although at first they fly out upon their invader, and actually oblige him to retire, this is but for a few minutes, until he has rolled himself upon the ground, and thus crushed such as stick to his skin; he then returns to the charge, and at last by perseverance, obliges them to abandon their combs; which he greedily devours, both wax and honey.

The chase of the fox requires less preparation than that of the wolf, and it is also more pleasant and amusing.[3] As dogs have a natural repugnance to pursue the wolf, so they are equally alert in following the fox; which they prefer even to the chase of the hare or the buck. The huntsmen, as upon other occasions, have their cant terms for every part of this chase. The fox the first year is called *a cub;* the second, *a fox;* and the third, an *old fox;* his tail is called the *brush* or *drag;* and his excrement, the *biliting.* He is usually pursued by a large kind of harrier or hound, assisted by terriers, or a smaller breed, that follow him into his kennel, and attack him there. The instant he perceives himself pursued, he makes to his kennel, and takes refuge at the bottom of it, where for a while he loses the cry of his enemies; but the whole pack coming to the mouth, redouble their vehemence and rage, and the little terrier boldly ventures in. It happens that the kennel is made under a rock, or among the roots of old trees; and in such cases the fox cannot be dug out, nor is the terrier able to contend with him at the bottom of his hole. By this contrivance he continues secure; but when he can be dug out, the usual way is to carry him in a bag to some open country, and there set him loose before the hounds. The hounds and the men follow, barking and shouting wherever he runs; and the body being strongly employed, the mind has not time to make any reflection on the futility of the pursuit. What adds to this entertainment is the strong scent which the fox leaves, that always keeps up a full cry; although, as his scent is stronger than that of the hare, it is much sooner evaporated. His shifts to escape, when all retreat is cut off to his kennel, are various and surprising. He always chooses the most woody country, and takes those paths that are most embarrassed with thorns and briars. He does not double, nor use the unavailing shifts of the hare; but flies in a direct line before the hounds, though at no very great distance; manages his strength; takes to the low and plashy grounds, where the scent will be less apt to lie; and at last, when overtaken, he defends himself with desperate obstinacy, and fights in silence to the very last gasp.

---

[1] Buffon, Renard.

[2] Buffon, Renard.

[3] Melton Mowbray, a small town in Leicestershire, generally contains from two to three hundred hunters, in the hands of the most experienced grooms England can produce, the average number being ten to each sportsman residing there, although some of those who ride heavy, and rejoice in long purses, have from fourteen to twenty for their own use. The stud of the earl

The fox, though resembling the dog in many respects, is nevertheless very distinct in his nature, refusing to engender with it; and though not testifying the antipathy of the wolf, yet discovering nothing more than an indifference. This animal also brings forth fewer at a time than the dog, and that but once a-year. Its litter is generally from four to six, and seldom less than three. The female goes with young about six weeks, and seldom stirs out while pregnant, but makes a bed for her young, and takes every precaution to prepare for their production. When she finds the place of their retreat discovered, and that her young have been disturbed during her absence, she removes them one after the other in her mouth, and endeavours to find them out a place of better security. A remarkable instance of this animal's parental affection happened while I was writing this history, in the county of Essex. A she-fox that had, as it should seem, but one cub, was unkennelled by a gentleman's hounds near Chelmsford, and hotly pursued. In such cases, when her own life was in imminent peril, one would think it was not a time to consult the safety of her young; however, the poor animal, braving every danger, rather than leave her cub behind to be worried by the dogs, took it up in her mouth, and ran with it in this manner for some miles. At last, taking her way through a farmer's yard, she was assaulted by a mastiff, and at last obliged to drop her cub, which was taken up by the farmer. I was not displeased to hear that this faithful creature escaped the pursuit, and at last got off in safety. The cubs of the fox are born blind, like those of the dog; they are eighteen months or two years in coming to

---

of Plymouth has, for many years, exceeded the last mentioned number. It may seem strange that one man should, under any circumstances, need so large a number of horses solely for his personal use in the field; and it must be admitted that few countries do require it. In Leicestershire, however, the universal practice is, for each sportsman to have at least two hunters in the field on the same day—a practise proved to be economical, as it is from exhaustion, the effect of long continued severe work, that the health of horses is most injured. And when it is considered that a horse should always have five days' rest after a moderate, and at least seven or eight after a severe run with hounds, it will not seem surprising that ten or twelve hunters should be deemed an indispensable stud for a regular Leicestershire sportsman. The sum total of expenses attending a stud of twelve hunters at Melton, including every outgoing, is, as nearly as can be estimated, £1000 per annum. In all stables, the outlay for the purchase of horses is great —at least two hundred guineas each hunter; and, in some, the annual amount of tear and wear of horse flesh is considerable. Melton has been much improved owing to the numbers of comfortable houses which have been erected for the accommodation of its sporting visitors, who spend not less, on an average, than £50,000 per annum on the spot. It stands on one of the great north roads, eighteen miles from Nottingham, and fifteen from Leicester, which latter place is also a favourite resort of sportsmen. The town furnishes an interesting scene on each hunting morning. At rather an early hour are to be seen groups of hunters, the finest in the world, setting out in different directions to meet different packs of hounds. The *style* of your Meltonian fox-hunter has long distinguished him above his brethren of what he calls the *provincial* chase. When turned out of the hands of his valet, he presents the very *beau-ideal* of his *caste*. The exact Stultz-like fit of his coat—his superlatively well-cleaned breeches and boots—and the generally apparent high-breeding of the man, can seldom be matched elsewhere; and the most cautious sceptic in such points would satisfy himself of the fact at one single inspection.—*Quarterly Review.*

perfection, and live about twelve or fourteen years.

As the fox makes war upon all animals, so all others seem to make war upon him. The dog hunts him with peculiar acrimony; the wolf is still a greater and more necessitous enemy, who pursues him to his very retreat. Some pretend to say that, to keep the wolf away, the fox lays at the mouth of its kennel a certain herb, to which the wolf has a particular aversion. This, which no doubt is a fable, at least shows that these two animals are as much enemies to each other as to all the rest of animated nature. But the fox is not hunted by quadrupeds alone; for the birds, who know him for their mortal enemy, attend him in his excursions, and give each other warning of their approaching danger. The daw, the magpie, and the blackbird, conduct him along, perching on the hedges as he creeps below, and, with their cries and notes of hostility, apprize all other animals to beware; a caution which they perfectly understand, and put into practice. The hunters themselves are often informed by the birds of the place of his retreat, and set the dogs into those thickets where they see them particularly noisy and querulous. So that it is the fate of this petty plunderer to be detested by every rank of animals: all the weaker classes shun, and all the stronger pursue him

The fox, of all wild animals, is most subject to the influence of climate; and there are found as many varieties in this kind almost as in any of the domestic animals.[1] The generality of foxes, as is well known, are red; but there are some, though not in England, of a grayish cast; and Mr Buffon asserts, that the tip of the tail in all foxes is white; which, however, is not so in those of this country. There are only three varieties of this animal in Great Britain, and these are rather established upon a difference of size than of colour or form. The greyhound fox is the largest, tallest, and boldest; and will attack a grown sheep. The mastiff fox is less, but more strongly built. The cur fox is the least and most common; he lurks about hedges and outhouses, and is the most pernicious of the three to the peasant and the farmer.

In the colder countries round the pole, the foxes are of all colours,[2] black, blue, gray, iron-gray, silver-gray, white, white with red legs, white with black heads, white with the tip of the tail black, red with the throat and belly entirely white, and lastly with a stripe of black running along the back, and another crossing it at the shoulders.[3] The common kind, however, is more universally diffused than any of the former, being found in Europe, in the temperate climates of Asia, and also in America; they are very rare in Africa, and in the countries lying under the torrid zone. Those travellers who talk of having seen them at Calicut, and other parts of Southern India, have mistaken the jackal for the fox. The fur of the white fox is held in no great estimation, because the hair falls off. The blue fox-skins are bought up with great avidity, from their scarceness; but the black fox-skin is of all others the most esteemed, a single skin often selling for forty or fifty crowns. The hair of these is so disposed, that it is impossible to tell which way the grain lies; for if we hold the skin by the head, the hair hangs to the tail; and if we hold it by the tail, it hangs down equally smooth and even to the head. These are often made into men's muffs, and are at once very beautiful and warm. In our temperate climate, however, furs are of very little service, there being scarce any weather so severe in England from which our ordinary clothes may not very well defend us.

THE JACKAL.

The jackal is one of the commonest wild animals in the East; and yet there is scarcely any less known in Europe, or more confusedly described by natural historians. In general, we are assured that it resembles the fox in figure and disposition, but we are still ignorant of those nice distinctions by which it is known to be of a different species. It is said to be of the size of a middling dog, resembling the fox in the hinder parts, particularly the tail; and the wolf in the fore parts, especially the nose. Its legs are shorter than those of the fox, and its colour is of a bright yellow, or sorrel, as we express it in horses. This is the reason it has been called in Latin the *golden wolf;* a name, however, which is entirely unknown in the countries where they are most common.

The species of the jackal is diffused all over Asia, and is found also in most parts of Africa, seeming to take up the place of the wolf, which, in those countries, is not so common. There seem to be many varieties among them: those of the warmest climates appear to be the largest, and their colour is rather of a reddish brown, than of that beautiful yellow by which the smaller jackals are chiefly distinguished.

---

[1] Buffon, Renard.

[2] The red foxes (see Plate XIII. fig. 59.) are so abundant in the wooded districts of the fur countries that about eight thousand skins are annually imported from America to Britain. The fur of the black fox is highly valued.

[3] Buffon, Renard.

Although the species of the wolf approaches very near to that of the dog, yet the jackal seems to be placed between them: to the savage fierceness of the wolf, it adds the impudent familiarity of the dog.[1] Its cry is a howl, mixed with barking, and a lamentation resembling that of human distress. It is more noisy in its pursuits even than the dog, and more voracious than the wolf. The jackal never goes alone, but always in a pack of forty or fifty together. These unite regularly every day to form a combination against the rest of the forest. Nothing then can escape them; they are content to take up with the smallest animals; and yet, when thus united, they have courage to face the largest. They seem very little afraid of mankind, but pursue their game to the very doors, without testifying either attachment or apprehension. They enter insolently into the sheep-folds, the yards, and the stables; and when they can find nothing else, devour the leather-harness, boots, and shoes, and run off with what they have not time to swallow.

They not only attack the living, but the dead. They scratch up with their feet the new-made graves, and devour the corpses, how putrid soever. In those countries, therefore, where they abound, they are obliged to beat the earth over the grave, and mix it with thorns, to prevent the jackals from scraping it away. They always assist each other, as well in this employment of exhumation, as in that of the chase. While they are at this dreary work, they exhort each other by a most mournful cry, resembling that of children under chastisement; and when they have thus dug up the body, they share it amicably between them. These, like all other savage animals, when they have once tasted of human flesh, can never after refrain from pursuing mankind. They watch the burying-grounds, follow armies, and keep in the rear of caravans. They may be considered as the vulture of the quadruped kind; every thing that once had animal life seems equally agreeable to them; the most putrid substances are greedily devoured; dried leather, and any thing that has been rubbed with grease, how insipid soever in itself, is sufficient to make the whole go down.

They hide themselves in holes by day, and seldom appear abroad till night-fall, when the jackal that has first hit upon the scent of some larger beast gives notice to the rest by a howl, which it repeats as it runs; while all the rest that are within hearing pack in to its assistance. The gazelle, or whatever other beast it may be, finding itself pursued, makes off towards the houses and the towns; hoping, by that means, to deter its pursuers from following; but hunger gives the jackal the same degree of boldness that fear gives the gazelle, and it pursues even to the verge of the city, and often along the streets. The gazelle, however, by this means, most frequently escapes; for the inhabitants sallying out, often disturb the jackal in the chase; and as it hunts by the scent, when once driven off, it never recovers it again. In this manner we see how experience prompts the gazelle, which is naturally a very timid animal, and particularly fearful of man, to take refuge near him, considering him as the least dangerous enemy, and often escaping by his assistance.

But man is not the only intruder upon the jackal's industry and pursuits. The lion, the tiger, and the panther, whose appetites are superior to their swiftness, attend to its call, and follow in silence at some distance behind.[2] The jackal pursues the whole night with unceasing assiduity, keeping up the cry, and with great perseverance at lasts tires down its prey; but just at the moment it supposes itself going to share the fruits of its labour, the lion or the leopard comes in, satiates himself upon the spoil, and his poor provider must be content with the bare carcase he leaves behind. It is not to be wondered at, therefore, if the jackal be voracious, since it so seldom has a sufficiency; nor that it feeds on putrid substances, since it is not permitted to feast on what it has newly killed. Besides these enemies, the jackal has another to cope with; for between him and the dog there is an irreconcilable antipathy, and they never part without an engagement. The Indian peasants often chase them as we do foxes; and have learned by experience, when they have got a lion or a tiger in their rear. Upon such occasions they keep their dogs close, as they would be no match for such formidable animals, and endeavour to put them to flight with their cries. When the lion is dismissed, they more easily cope with the jackal, who is as stupid as it is impudent, and seems much better fitted for pursuing than retreating. It sometimes happens that one of them steals silently into an out-house, to seize the poultry, or devour the furniture; but hearing others in full cry at a distance, without thought, it instantly answers the call, and thus betrays its own depredations. The peasants sally out upon it, and the foolish animal finds, too late, that its instinct was too powerful for its safety.[1]

---

[1] Buffon, vol. xxvii. p. 52.

[2] Sinnæi Systema, p. 60.

THE ISATIS.

As the jackal is a sort of intermediate species between the dog and the wolf,[2] so the isatis may be considered as placed between the dog and the fox. This animal has hitherto been supposed to be only a variety of the latter; but from the latest observations, there is no doubt of their being perfectly distinct. The isatis is very common in all the northern countries bordering upon the Icy Sea; and is seldom found, except in the coldest countries. It extremely resembles the fox, in the form of its body, and the length of its tail; and a dog, in the make of its head and the position of its eyes. The hair of these animals is softer than that of a common fox; some are blue, some are white at one season, and at another of a russet brown. Although the whole of its hair be two inches long, thick, tufted, and glossy, yet the under jaw is entirely without any, and the skin appears bare in that part.

This animal can bear only the coldest climates, and is chiefly seen along the coasts of the Icy Sea, and upon the banks of the great rivers that discharge themselves therein. It is chiefly fond of living in the open country, and seldom seen in the forest, being mostly found in the mountainous and naked regions of Norway, Siberia, and Lapland. It burrows like the fox; and, when with young, the female retires to her kennel, in the same manner as the fox is seen to do. These holes, which are very narrow, and extremely deep, have many outlets. They are kept very clean, and are bedded at the bottom with moss, for the animal to be more at its ease. Its manner of coupling, time of gestation, and number of young, are all similar to what is found in the fox; and it usually brings forth at the end of May or the beginning of June.

Such are the particulars in which this animal differs from those of the dog kind, and in which it resembles them; but its most striking peculiarity remains still to be mentioned; namely, its changing its colour, and being seen at one time brown, and at another perfectly white. As was already said, some are naturally blue, and their colour never changes; but such as are to be white, are, when brought forth, of a yellow hue, which, in the beginning of September, is changed to white, all except along the top of the back, along which runs a stripe of brown, and another crossing it down the shoulders, at which time the animal is called the *crossed fox;* however, this brown cross totally disappears before winter, and then the creature is all over white, and its fur is two inches long; this, about the beginning of .May, again begins to fall; and the moulting is completed about the middle of July, when the isatis becomes brown once more. The fur of this animal is of no value, unless it be killed in winter.

THE HYÆNA.[3]

The hyæna is the last animal I shall mention among those of the dog kind, which it, in many respects, resembles, although too strongly marked to be strictly reduced to any type. The hyæna is nearly of the size of a wolf; and has some similitude to that animal in the shape of its head and body. The head, at first sight does

---

[1] The jackal has been popularly called the lion's provider. The common notion that he is in confederacy with the lion, for the chase of their mutual prey, is an erroneous one. At the cry of the jackal, echoed as it is by hundreds of similar voices through the woods and arid plains, the lion, whose ear is dull, rouses himself into action. He knows that some unhappy wanderer from the herds has crossed the path of the jackal, and he joins in the pursuit.—"The cry of the jackal," says Captain Beechy, "has something in it rather appalling, when heard for the first time at night; and as they usually come in packs, the first shriek which is uttered is always the signal for a general chorus. We hardly know a sound which partakes less of harmony than that which is at present in question; and, indeed, the sudden burst of the answering long-protracted scream, succeeding immediately to the opening-note, is scarcely less impressive than the roll of the thunder-clap immediately after a flash of lightning. The effect of this music is very much increased when the first note is heard in the distance (a circumstance which often occurs) and the answering yell bursts out from several points at once, within a few yards, or feet, of the place where the auditors are sleeping."

[2] In this description I have followed Mr Buffon.—*Goldsmith.*

[3] Naturalists long ranked hyænas as dogs; but Cuvier has detected a very striking difference in the formation of the teeth, and has in consequence formed a new genus for them, under the name of Hyæna. The hyæna is about the size of a large dog, and usually measures about nineteen inches in height at the shoulders, the ordinary length of the body, from the muzzle to the tail, being generally three feet three inches; the hair is of an ash-colour, very coarse and rough, variegated with long black waved stripes, which commence at the spine, and continue down the sides and under the belly; the legs have irregular rings of black; the neck and back are provided with a hog-like bristly mane; and the tail is covered with long stiffish hairs. Its fur is composed of two sorts of hair, one of which is woolly, and very small in quantity, and the other of a silky texture, long, stiff, and not very thick, excepting on the limbs, where the hair is short and close; and has the appearance of being shaven on the muzzle. Only two species of the hyæna are now known, the striped and the spotted.

The *striped hyæna* is a native of Asiatic Turkey, Barbary, Egypt, Nubia, Abyssinia, Syria, Persia, and many other parts of Africa, where it resides in caverns of mountains, clefts of rocks, or burrows dug by itself. It is of an exceedingly ferocious and malignant disposition, not appear to differ, except that the ears of the hyæna are longer, and more without hair; but, upon observing more closely, we shall find the head broader, the nose flatter, and not so pointed. The eyes are not placed obliquely, but more like those of a dog. The legs, particularly the hinder, are longer than those either of the dog or the wolf, and different from all other quadrupeds, in having but four toes, as well on the fore-feet as on the hinder. Its hair is of a dirty grayish, marked with black, disposed in waves down its body. Its tail is short, with pretty long hair; and immediately under it, above the anus, there is an opening into a kind of glandular pouch, which separates a substance of the consistence, but not of the odour, of civet. This opening might have given rise to the error of the ancients, who asserted that this animal was every year alternately male and female. Such are the most striking distinctions of the hyæna, as given us by naturalists; which, nevertheless,

---

and although taken very young, can never be thoroughly domesticated. The courage of the hyæna is equal to its rapacity: it will defend itself against much larger animals, and has been known to combat even with the lion and the panther, and is said to be more than a match for the ounce. The hyæna generally hunts for its prey during the night, and attacks every living animal it meets with; cattle are often killed by it, and sheep-folds are frequently devastated by this rapacious animal. Hyænas have been known to collect in vast troops, and following an army, feasting on the dead left behind on the battle-field: it has been also said, that when pressed with hunger they will even ransack the repositories of the dead, and greedily devour putrid carcasses. Like the dog, wolf, and fox, with which they are closely allied, they will also subsist on the roots of plants and the shoots of palms, but this is only when they cannot procure animal food. The cry of the hyæna is very peculiar and dismal: its commencement is somewhat like the moaning of a human being, and ends like a person making a violent and strained effort to vomit. Although naturally extremely ferocious, it has been in a few instances rendered tolerably domestic. Buffon mentions one at Paris which was apparently freed from his natural destructive qualities; and Pennant says he saw one nearly as tame as a dog.

Mr Bruce, while in Africa, confined a hyæna, in the same apartment with a lamb, a goat, and a kid, for a whole day, and even without giving the hyæna any food, and he found his harmless companions quite safe in the evening. Bruce says the hyænas of Abyssinia prowl about in the day-time as well as at night. "These creatures," says he, "were a general scourge to Abyssinia, in every situation, both in the city and in the field, and, I think, surpassed the sheep in number. Gondor was full of them, from evening till the dawn of day, seeking the different pieces of slaughtered carcasses which this cruel and unclean people expose in the streets without burial. Many a time in the night, when the king had kept me late in the palace, and it was not my duty to lie there, in going across the square from the king's house, not many hundred yards distant, I have been apprehensive lest they should bite me in the leg. They grunted in great numbers about me, although I was surrounded by several armed men, who seldom passed a night without wounding or slaughtering some of them."

We are told by Mr Pringle that hyænas are the general scavengers of the country, never failing to devour the carcasses, and in great part the skeletons, of dead animals, and the refuse left by other beasts of prey; and we have his authority, as well as that of Mr Brown, that they even devour their own species when they find a dead one. Mr Pringle says, that the flesh of the spotted hyæna is so rank and offensive that no other beast of prey but their own species will come near it. At Dar Für, in the interior of Africa, hyænas enter the villages every night in small herds of from six to fifteen, and carry off every animal they are capable of destroying. Dogs, asses, and horses, are frequently their victims; and if they meet with a dead camel, they generally contrive to remove it, and are not to be intimidated either by man or the discharge of fire-arms.

Mr John Hunter had at Earle's court a hyæna, nearly 18 months old, that was so tame as to allow strangers to approach and touch him. After Mr Hunter's death, he was sold to a travelling exhibitor of animals. For a few months previous to his being carried into the country, he was lodged in the tower of London. He was so gentle there that he allowed a person who knew him to enter his den and handle him. When he was confined in the caravan, he soon exhibited symptoms of ferocity equal to those of the most savage of his kind. He was at last killed by a tiger, the partition between whose den and his own he had torn down by the enormous strength of his jaws. The hyæna in confinement is allowed four pounds weight of food in the day, and he laps about three English pints of water.

The *spotted hyæna* (See Plate XIII. fig. 53) inhabits Southern Africa, abounding in the neighbourhood of the Cape. The mane of this species reaches only to the loins, and the remaining part consists chiefly of scattered hairs. The general colour of the spotted hyæna is reddish-brown, marked with cross bars on the hind-legs; the head is much larger than that of the other species, and flat; its ears are large, flat, and rounded. The spotted hyæna has great muscular strength in its neck, and its voice is still more remarkable than that of the common hyæna; it commences with a strange hollow sound, and ends in a hoarse kind of laugh, from which circumstance it has obtained the name of the laughing hyæna.

THE HYÆNA.

Connected with the history of the hyæna, is the curious fact of numerous bones of these animals having been found in different parts of Europe in a fossil state, from which it has been inferred that this animal had originally been a native of Europe, and even of Britain. For, in a cavern at Kirkdale, in Yorkshire, a large collection of these bones were recently discovered; and they have also been found at Crawly Rocks, near Swansea, in Wales, in the Mendip hills at Clifton; at Wirksworth, in Derbyshire; at Paviland Cave, Glamorganshire; and Creston, near Plymouth.

Baron Cuvier says, that the bones of the fossil hyæna indicate the size of an animal which must have been somewhat larger than the striped species, and the teeth are formed like those of the spotted animal, but somewhat larger, so that their powers of gnawing must have considerably exceeded those now existing.

convey but a very confused idea of the peculiarity of its form. Its manner of holding the head seems remarkable; somewhat like a dog pursuing the scent, with the nose near the ground. The head being held thus low, the back appears elevated, like that of the hog, which, with a long bristly band of hair that runs all along, gives it a good deal the air of that animal; and, it is probable, that from this similitude it first took its name; the word *huaina* being Greek, and derived from *hus*, which signifies a *sow*.

But no words can give an adequate idea of this animal's figure, deformity, and fierceness; more savage and untameable than any other quadruped, it seems to be for ever in a state of rage or rapacity, for ever growling, except when receiving its food. Its eyes then glisten, the bristles of its back all stand upright, its head hangs low, and yet its teeth appear; all which give it a most frightful aspect, which a dreadful howl tends to heighten. This, which I have often heard, is very peculiar; its beginning resembles the voice of a man moaning, and its latter part as if he were making a violent effort to vomit. As it is loud and frequent, it might, perhaps, have been sometimes mistaken for that of a human voice in distress, and have given rise to the accounts of the ancients, who tell us, that the hyæna makes its moan to attract unwary travellers, and then to destroy them: however this be, it seems the most untractable, and, for its size, the most terrible of all other quadrupeds; nor does its courage fall short of its ferocity; it defends itself against the lion, is a match for the panther, attacks the ounce, and seldom fails to conquer.

It is an obscene and solitary animal, to be found chiefly in the most desolate and uncultivated parts of the torrid zone, of which it is a native.[1] It resides in the caverns of mountains, in the cliffs of rocks, or in dens that it has formed for itself under the earth. Though taken ever so young, it cannot be tamed; it lives by depredation, like the wolf, but is much stronger, and more courageous.—It sometimes attacks man, carries off cattle, follows the flock, breaks open the sheep-cots by night, and ravages with insatiable voracity. Its eyes shine by night; and it is asserted, not without great appearance of truth, that it sees better by night than by day. When destitute of other provision, it scrapes up the graves, and devours the dead bodies, how putrid soever. To these dispositions, which are sufficiently noxious and formidable, the ancients have added numberless others, which are long since known to be fables: as, for instance, that the hyæna was male and female alternately; that having brought forth and suckled its young, it then changed sexes for a year, and became a male. This, as was mentioned above, could only proceed from the opening under the tail, which all animals of this species are found to have; and which is found in the same manner in no other quadruped, except the badger. There is, in the weasel kind indeed, an opening, but it is lower down, and not placed above the anus, as in the badger and the hyæna. Some have said that this animal changed the colour of its hair at will; others, that a stone was found in its eye, which, put under a man's tongue, gave him the gift of prophecy; some have said that it had no joints in the neck, which, however, all quadrupeds are known to have; and some, that the shadow of the hyæna kept dogs from barking. These, among many other absurdities, have been asserted of this quadruped; and which I mention to show the natural disposition of mankind, to load those that are already but too guilty with accumulated reproach.

CHAP. III.

OF ANIMALS OF THE WEASEL KIND.

Having described the bolder ranks of carnivorous animals, we now come to a minuter and more feeble class, less formidable indeed than any of the former, but far more numerous, and, in proportion to their size, more active and enterprising. The weasel kind may be particularly distinguished from other carnivorous animals, by the length and slenderness of their bodies, which are so fitted as to wind, like worms, into very small openings, after their prey; and hence also they have received the name of vermin, from their similitude to the worm in this particular. These animals differ from all of the cat kind, in the formation and disposition of their claws, which, as in the dog kinds, they can neither draw in nor extend at pleasure, as cats are known to do. They differ from the dog kind, in being clothed rather with fur than hair; and although some varieties of the fox may resemble them in this particular, yet the coat of the latter is longer, stronger, and always more resembling hair. Beside these distinctions, all animals of the weasel kind have glands placed near the anus, that either open into or beneath it, furnishing a substance that, in some, has the most offensive smell in nature, in others the most pleasing perfume. All of this kind are still more marked by their habitudes and dispositions, than their external form; cruel, voracious, and cowardly, they subsist only by theft, and find their chief protection in their minuteness. They are all, from the shortness of their legs, slow in pursuit; and, therefore, owe their support to their patience, assiduity, and cunning. As their prey is precarious, they live a long time without food; and if they happen to fall in where it is plenty, they instantly destroy all about them before they begin to satisfy their appetite, and suck the blood of every animal before they begin to touch its flesh.

---

[1] Buffon.

These are the marks common to this kind, all the species of which have a most striking resemblance to each other; and he that has seen one, in some measure may be said to have seen all. The chief distinction in this numerous class of animals, is to be taken from the size; for no words can give the minute irregularities of that outline by which one species is to be distinguished from that which is next it. I will begin, therefore, with the least and the best known of this kind, and still marking the size, will proceed gradually to larger and larger, until we come from the weasel to the glutton, which I take to be the largest of all. The weasel will serve as a model for all the rest; and, indeed, the points in which they differ from this little animal, are but very inconsiderable.

The **weasel**,[1] as was said, is the smallest of this numerous tribe; its length not exceeding seven inches, from the tip of the nose to the insertion of the tail. This length, however, seems to be very great, if we compare it with the height of the animal, which is not above an inch and a half.[2] In measuring the wolf, we find him to be not above once and a half as long as he is high; in observing the weasel, we find it near five times as long as it is high, which shows an amazing disproportion. The tail, also, which is bushy, is two inches and a half long, and adds to the apparent length of this little animal's body. The colour of the weasel is a pale reddish brown on the back and sides, but white under the throat and the belly. It has whiskers like a cat; and thirty-two teeth, which is two more than any of the cat kind; and these also seem better adapted for tearing and chewing, than those of the cat are. The eyes are little and black. The ears short broad, and roundish; and have a fold at the lower part, which makes them look as if they were double. Beneath the corners of the mouth, on each jaw, is a spot of brown.

This animal, though very diminutive to appearance, is, nevertheless, a very formidable enemy to quadrupeds a hundred times its own size. It is very common and well known in most parts of this country; but seems held in very different estimation in different parts of it. In those places where sheep or lambs are bred, the weasel is a most noxious inmate, and every art is used to destroy it; on the contrary, in places where agriculture is chiefly followed, the weasel is considered as a friend that thins the number of such vermin as chiefly live upon corn: however, in all places, it is one of the most untameable and untractable animals in the world.[3] When kept in a cage, either for the purposes of amusement or inspection, it will not touch any part of its victuals while any body looks on. It keeps in a continual agitation, and seems frightened so much at the sight of mankind, that it will die, if not permitted to hide itself from their presence.[4] For this purpose, it must be provided, in its cage, with a sufficient quantity of wool or hay, in which it may conceal itself, and where it may carry whatever it has got to eat; which, however, it will not touch until it begins to putrefy. In this state it is seen to pass three parts of the day in sleeping; and reserves the night for its times of exercise and eating.

In its wild state, the night is likewise the time during which it may be properly said to live. At the approach of evening, it is seen stealing from its hole, and creeping about the farmer's yard for its prey. If it enters the place where poultry are kept, it never attacks the cocks or the old hens, but immediately aims at the young ones. It does not eat its prey on the place, but, after killing it by a single bite near the head, and with a wound so small that the place can scarcely be perceived, it carries it off to its young, or its retreat. It also breaks and sucks the eggs, and sometimes kills the hen that attempts to defend them. It is remarkably active; and, in a confined place, scarcely any animal can escape it. It will run up the sides of walls with such facility, that no place is secure from it; and its body is so small, that there is scarcely any hole but what it can wind through. During the summer, its excursions are more extensive; but in winter, it chiefly confines itself in barns and farm-yards, where it remains till spring, and where it brings forth its young. All this season it makes war upon the rats and mice, with still greater success than the cat; for being more active and slender, it pursues them into their holes, and after a short resistance destroys them. It creeps also into pigeon holes, destroys the young, catches sparrows, and all kinds of small birds; and, if it has brought forth its young, hunts with still greater boldness and avidity. In summer, it ventures farther from the house; and particularly goes into those places where the rat, its chiefest prey, goes before it. Accordingly, it is found in the lower grounds, by the side of waters, near mills, and is often seen to hide its young in the hollow of a tree.

---

[1] British Zoology, vol. i. p. 83.

[2] The height of the weasel is about *two* inches and a half. Great differences in size are exhibited by this species, and the male is said to be much larger than the female.

[3] Buffon, vol. xv. p. 37.

[4] There are several instances on record of the domestication of the weasel. The usual method of taming those creatures is, to stroke them gently over the back; and to threaten, and even to beat them, when they attempt to bite. Aldrovandus observes, that their teeth should be rubbed with garlic, which will take away all their inclination to bite. The motion of these animals consists of unequal leaps; and, on occasion, they have the power of springing some feet from the ground. They are remarkably active, and will run up a wall with such facility, that no place is secure from them. Their bite is generally fatal, as they seize their prey near the head, and fix their teeth into a vital part. The wound is so minute, that the place where the teeth enter is hardly perceptible; but a hare, rabbit, or other small animal, bitten in this manner, is never known to recover.

The female takes every precaution to make an easy bed for her little ones: she lines the bottom of her hole with grass, hay, leaves, and moss, and generally brings forth from three to five at a time. All animals of this, as well as those of the dog kind, bring forth their young with closed eyes: but they very soon acquire strength sufficient to follow the dam in her excursions, and assist her in projects of petty rapine. The weasel, like all others of its kind, does not run on equably, but moves by bounding; and when it climbs a tree, by a single spring it gets a good way from the ground. It jumps in the same manner upon its prey; and having an extremely limber body, evades the attempts of much stronger animals to seize it.

This animal, like all of its kind, has a very strong smell; and that of the weasel is peculiarly fœtid. This scent is very distinguishable in those creatures, when they void their excrement; for the glands which furnish this fœtid substance, which is of the consistence of suet, open directly into the orifice of the anus, and taint the excrement with the strong effluvia. The weasel smells more strongly in summer than in winter; and more abominably when irritated or pursued, than when at its ease. It always preys in silence, and never has a cry except when struck, and then it has a rough kind of squeaking, which at once expresses resentment and pain. Its appetite for animal food never forsakes it; and it seems even to take a pleasure in the vicinity of putrefaction. Mr Buffon tells us of one of them being found with three young ones in the carcase of a wolf that was grown putrid, and that had been hung up by the hind legs, as a terror to others. Into this horrid retreat the weasel thought proper to retire to bring

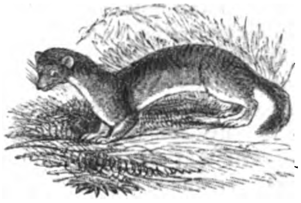
---

The following incident regarding the weasel, occurred in Selkirkshire.—A group of haymakers, while busy at their work on Chapelhope meadow, saw an eagle rising above the steep mountains that inclose the narrow valley. The eagle himself was, indeed, no unusual sight; but there is something so imposing and majestic in the flight of this noble bird, while he soars upwards in spiral circles, that it fascinates the attention of most people. But the spectators were soon aware of something peculiar in the flight of the bird they were observing. He used his wings violently; and the strokes were often repeated, as if he had been alarmed and hurried by unusual agitation; and they noticed, at the same time, that he wheeled in circles that seemed constantly decreasing, while his ascent was proportionally rapid. The now idle haymakers drew together in close consultation on the singular case, and continued to keep their eyes on the seemingly distressed eagle, until he was nearly out of sight, rising still higher and higher into the air. In a short while, however, they were all convinced that he was again seeking the earth, evidently not as he ascended, in spiral curves; it was like something falling, and with great rapidity. But, as he approached the ground, they clearly saw he was tumbling in his fall like a shot bird; the convulsive fluttering of his powerful wings stopping the descent but very little, until he fell at a small distance from the men and boys of the party, who had naturally run forward, highly excited by the strange occurrence. A large black-tailed weasel or stoat ran from the body as they came near, turned with the usual *nonchalance* and impudence of the tribe, stood up upon its hind legs, crossed its fore paws over its nose, and surveyed its enemies a moment or two (as they often do when no dog is near,) and bounded into a saugh bush. The king of the air was dead; and, what was more surprising, he was covered with his own blood; and, upon further examination, they found his throat cut, and the stoat has been suspected as the regicide unto this day.

This singular story, says a correspondent in the Magazine of Natural History, I always looked upon as too good to be true, until lately a friend mentioned the following fact which came under his own observation:—A light snow covered the ground; and he, having walked out to an adjoining hill to meet with one of his shepherds, fell in with the track of one of these weasels, which is easily to be distinguished from that of the smaller species, by the larger footprint and length of the spring, among the snow. He followed the track for some time, for his amusement, along the side of the hill, until he came to the marks where a pair of grouse had been sitting, when he lost all traces of the weasel, and could follow it no farther. As there was no appearance of a hole, he was much surprised; and paying close attention to the track of the animal, he came to be convinced that it had sprung upon one of the birds, which had flown away with it. As he is a person of uncommonly acute observation, sound judgment, and strong sense, I have the utmost confidence in the correctness of his judgment regarding this curious circumstance. The conclusion is, that the stoat knew quite well what it was about, and would keep its hold until it came to the ground again, under similar circumstances with the eagle. The matchless agility and comparative strength of this bold little creature would enable it to save itself during the fall; before which took place, it had probably, as in the former strange instance, destroyed the life of its more harmless prey.

forth her young; she had furnished the cavity with hay, grass, and leaves; and the young were just brought forth when they were discovered by a peasant passing that way.

THE ERMINE, OR STOAT.



Next to the weasel in size, and perfectly alike in figure, is the ermine.[1] The difference between this and the former animal is so very small, that many, and among the rest Linnæus, who gives but one description of both, have confounded the two kinds together. However, their differences are sufficient to induce later naturalists to suppose the two kinds distinct; and as their lights seem preferable, we choose to follow their descriptions.

The stoat or ermine differs from the weasel in size, being usually nine inches long; whereas the former is not much above six. The tail of the ermine is always tipped with black, is longer in proportion to the body, and more furnished with hair. The edges of the ears and the ends of the toes in this animal are of a yellowish white; and although it is of the same colour with the weasel, being of a lightish brown, and though both this animal as well as the weasel, in the most northern parts of Europe, changes its colour in winter, and becomes white, yet even then the weasel may be easily distinguished from the ermine by the tip of the tail, which in the latter is always black.

It is well known that the fur of the ermine is the most valuable of any hitherto known; and it is in winter only that this little animal has it of the proper colour and consistence. In summer, the ermine, as was said before, is brown, and it may at that time more properly be called the *stoat*. There are few so unacquainted with quadrupeds as not to perceive this change of colour in the hair, which in some degree obtains in them all. The horse, the cow, and the goat, all manifestly change colour in the beginning of summer, the old long hair falling off, and a shorter coat of hair appearing in its room, generally of a darker colour, and yet more glossy. What obtains in our temperate climate is seen to prevail still more strongly in those regions where the winters are long and severe, and the summers short, and yet generally hot in an extreme degree. The animal has strength enough during that season to throw off a warm coat of fur, which would but incommode it, and continues for two or three months in a state somewhat resembling the ordinary quadrupeds of the milder climates. At the approach of winter, however, the cold increasing, the coat of hair seems to thicken in proportion; from being coarse and short, it lengthens and grows finer, while multitudes of smaller hairs grow up between the longer, thicken the coat, and give it all that warmth and softness which are so much valued in the furs of the northern animals.

It is no easy matter to account for this remarkable warmth of the furs of northern quadrupeds, or how they come to be furnished with such an abundant covering. It is easy enough, indeed, to say that nature fits them thus for the climate; and like an indulgent mother, when she exposes them to the rigour of an intemperate winter, supplies them with a covering against its inclemency. But this is only flourishing: it is not easy, I say, to tell how nature comes to furnish them in this manner. A few particulars on this subject are all that we yet know. It is observable among quadrupeds, as well as even among the human species itself, that a thin sparing diet is apt to produce hair; children that have been ill fed, famished dogs and horses, are more hairy than others whose food has been more plentiful. This may, therefore, be one cause that the animals of the north, in winter, are more hairy than those of the milder climates. At that season, the whole country is covered with deep snow, and the provisions which these creatures are able to procure can be but precarious and scanty. Its becoming finer may also proceed from the severity of the cold, that contracts the pores of the skin, and the hair consequently takes the shape of the aperture through which it grows, as wires are made smaller by being drawn through a smaller orifice. However this may be, all the animals of the arctic climates may be said to have their winter and summer garments, except very far to the north, as in Greenland, where the cold is so continually intense, and the food so scarce that neither the bears nor foxes change colour.[1]

---

[1] The length of the stoat is about ten inches, exclusive of the tail, which is five inches and a half; it is very hairy, tipped with black; the edges of the ears, and ends of the toes, are yellowish-white; in other respects, it resembles the weasel both in colour and form. In the northern parts of Europe, during winter, the fur changes to a pure white, except the tip of the tail, which retains its blackness through all seasons, and in every climate. In winter, it is called the *ermine;* and in this condition is much sought for, on account of the high value placed upon its fur, which has been that worn by royalty from very remote times. The stoat abounds in Norway, Lapland, Russia, and other northern climates, and forms a valuable article of commerce in these states. It is found even so far north as Kamschatka and Siberia, where the hunters take it with traps, baited with flesh. In Norway, it is their practice either to shoot the stoats with blunt arrows, or they are taken by traps, made by two flat stones, one being propped up with a stick, to which is attached a baited string; and as soon as the animal begins to nibble, the stone falls down, and crushes it to death. In Britain, they also sometimes change to white in winter; but their skin is of little value, compared to those in Northern Europe, having neither the closeness nor whiteness of fur. The skins are sold, in the districts where they are caught, at from two to three pounds sterling the hundred. In England, the ermine is less common than the weasel; in Scotland, for one weasel, there may be four or five ermines. When coloured red, they are called stoats; when white, ermines.

The following well-authenticated instance shows the extensive depredations of these animals:—About the middle of July 1827, a gentleman at Cathcart, near Glasgow, shot at and wounded a stoat. The animal escaped into a hole in an old stone wall. He was induced to explore the place of its retreat, when the first victims he met with were a couple of leverets immutilated; a little farther on two young partridges, also entire, and a pheasant's egg unbroken. Beyond these were found the heads of two other leverets, in a state of putrefaction; and at the extremity of the hole, lay the little mischievous marauder himself, dead. We would have thought this extraordinary accumulation of plunder was the consequence of a provident disposition in the animal, but, from the appearance of the leveret's head, &c., it seems to bear out what has been so often stated by naturalists of this tribe of animals, that they seldom devour any of their prey till it begins to putrefy.

The ermine, as was said, is remarkable among these for the softness, the closeness, and the warmth of its fur. It is brown in summer, like the weasel, and changes colour before the winter is begun, becoming a beautiful cream colour, all except the tip of the tail, as was said before, which still continues black. Mr Daubenton had one of these brought him with its white winter fur, which he put into a cage and kept, in order to observe the manner of moulting its hair. He received it in the beginning of March; in a very short time it began to shed its coat, and a mixture of brown was seen to prevail among the white; so that at the ninth of the same month, its head was nearly become of a reddish brown. Day after day this colour appeared to extend, at first along the neck and down the back in the manner of a stripe of about half an inch broad. The fore part of the legs then assumed the same colour; a part of the head, the thighs, and the tail, were the last that changed; but at the end of the month there was no white remaining except on those parts which are always white in this species, particularly the throat and the belly. However, he had not the pleasure of seeing this animal resume its former whiteness, although he kept it for above two years; which without doubt, was owing to its imprisoned state; this colour being partly owing to its stinted food, and partly to the rigour of the season. During its state of confinement, this little animal always continued very wild and untractable; for ever in a state of violent agitation, except when asleep, which it often continued for three parts of the day. Except for its most disagreeable scent, it was an extremely pretty creature, its eyes sprightly, its physiognomy pleasant, and its motions so swift that the eye could scarcely attend them. It was fed with eggs and flesh, but it always let them putrefy before it touched either. As some of this kind are known to be fond of honey, it was tried to feed this animal with such food for a while; after having, for three or four days deprived it of other food, it ate of this, and died shortly after; a strong proof of its being a distinct species from the pole-cat or the martin, which feed upon honey, but otherwise pretty much resemble the ermine in their figure and dispositions.

In the north of Europe and Siberia their skins make a valuable article of commerce, and they are found there much more frequently than among us. In Siberia they burrow in the fields, and are taken in traps baited with flesh. In Norway they are either shot with blunt arrows, or taken in traps made of two flat stones, one being propped with a stick to which is fastened a baited string, and when the animal attempts to pull this away, the stone drops and crushes them to death. This animal is sometimes found white in Great Britain, and is then called a white weasel. Its furs, however, among us are of no value, having neither the thickness, the closeness, nor the whiteness, of those which come from Siberia. The fur of the ermine, in every country, changes by time; for as much of its beautiful whiteness is given it by certain arts known to the furriers, so its natural colour returns, and its former whiteness can never be restored again.

THE FERRET.

The animal next in size to the ermine is the ferret; which is a kind of domestic in Europe, though said to be originally brought from Africa into Spain, which being a country abounding in rabbits, required an animal of this kind more than any other: however this be, it is not to be found at present among us, except in its domestic state; and it is chiefly kept tame, for the purposes of the warren.

The ferret is about one foot long, being nearly four inches longer than the weasel. It resembles that animal in the slenderness of its body, and the shortness of its legs; but its nose is sharper, and its body more slender, in proportion to its length. The ferret is commonly of a cream colour; but they are also found of all the colours of the weasel kind; white, blackish, brown, and party-coloured. Those that are of the whitish kind have their eyes red, as is almost general with all animals entirely of that colour. But its principal distinction from the weasel, is the length of the hair on its tail, which is much longer in the ferret than the weasel. Words will not well express the other distinctions; and what might take up a page in dull discrimination, a single glance of the eye, when the animals themselves are presented, can discover.

---

[1] Krantz's History of Greenland, vol 1. p. 72.

As this animal is a native of the torrid zone,[1] so it cannot bear the rigours of our climate without care and shelter; and it generally repays the trouble of its keeping, by its great agility in the warren. It is naturally such an enemy of the rabbit kind, that if a dead rabbit be presented to a young ferret, although it has never seen one before, it instantly attacks and bites it with an appearance of rapacity. If the rabbit be living, the ferret is still more eager, seizes it by the neck, winds itself round it, and continues to suck its blood, till it be satiated.[2]

Their chief use in warrens is to enter the holes, and drive the rabbits into the nets that are prepared for them at the mouth. For this purpose, the ferret is muzzled; otherwise, instead of driving out the rabbit, it would content itself with killing and sucking its blood at the bottom of the hole; but, by this contrivance, being rendered unable to seize its prey, the rabbit escapes from its claws, and instantly makes to the mouth of the hole with such precipitation, that it is inextricably entangled in the net placed there for its reception. It often happens, however, that the ferret disengages itself of its muzzle, and then it is most commonly lost, unless it be dug out; for, finding all its wants satisfied in the warren, it never thinks of returning to the owner, but continues to lead a rapacious solitary life while the summer continues, and dies with the cold of the winter. In order to bring the ferret from his hole, the owners often burn straw and other substances at the mouth; they also beat above to terrify it: but this does not always succeed; for as there are often several issues to each hole, the ferret is affected neither by the noise nor the smoke, but continues secure at the bottom, sleeping the greatest part of the time, and waking only to satisfy the calls of hunger.

The female of this species[3] is sensibly less than the male, whom she seeks with great ardour, and, it is said, often dies without being admitted. They are usually kept in boxes, with wool, of which they make themselves a warm bed, that serves to defend them from the rigour of the climate. They sleep almost continually; and the instant they awake, they seem eager for food. They are usually fed with bread and milk. They breed twice a-year. Some of them devour their young as soon as brought forth, and then become fit for the male again. Their number is usually from five to six at a litter; and this is said to consist of more females than males. Upon the whole, this is a useful, but a disagreeable and offensive animal; its scent is fœtid, its nature voracious, it is tame without any attachment, and such is its appetite for blood, that it has been known to attack and kill children in the cradle. It is very easy to be irritated; and, although at all times its smell is very offensive, it then is much more so; and its bite is very difficult of cure.

To the ferret kind we may add an animal which Mr Buffon calls the *vansire*, the skin of which was sent him stuffed from Madagascar. It was thirteen inches long, a good deal resembling the ferret in figure, but differing in the number of its grinding-teeth, which amounted to twelve; whereas in the ferret there are but eight: it differed also in colour, being of a dark brown, and exactly the same on all parts of its body. Of this animal, so nearly resembling the ferret, we have no other history but the mere description of its figure; and in a quadruped whose kind is so strongly marked, perhaps this is sufficient to satisfy curiosity.

THE POLECAT.[4]

The Polecat is larger than the weasel, the ermine, or the ferret, being one foot five inches long: whereas the weasel is but six inches, the ermine nine, and the ferret eleven inches. It so much resembles the ferret in form, that some have been of opinion they were one and the same animal; nevertheless, there are a sufficient number of distinctions between them: it is, in the first place, larger than the ferret; it is not quite so slender, and has a blunter nose; it differs also internally, having but fourteen ribs, whereas the ferret has fifteen; and wants one of the breast-bones, which is found in the ferret: however, warreners assert that the polecat will mix with the ferret; and they are sometimes obliged to procure an intercourse between these two animals to improve the breed of the latter, which, by long confinement, is sometimes seen to abate of its rapacious disposition. Mr Buffon denies that the ferret will admit the polecat; yet gives a variety, under the name of both animals, which may very probably be a spurious race between the two.

---

[1] Buffon.

[2] The ferret is also a great enemy to rats, and in that way is found to be serviceable to man.

[3] Buffon.

[4] The polecat is variously named *Fichet*, *Foumart*, or *Polecat*. The species is numerous in Britain, and most other parts of Europe. Lorraine, a province of France, is completely overrun with polecats, owing to some strange superstition of the inhabitants, who will not destroy them;

However this be, the polecat seems by much the more pleasing animal of the two; for although the long slender shape of all these vermin tribes gives them a very disagreeable appearance, yet the softness and colour of the hair in some of them atones for the defect, and renders them, if not pretty, at least not frightful. The polecat, for the most part, is of a deep chocolate colour; it is white about the mouth; the ears are short, rounded, and tipped with white; a little beyond the corners of the mouth a stripe begins, which runs backward, partly white and partly yellow: its hair, like that of all this class, is of two sorts, the long and the furry; but in this animal the two kinds are of different colours; the longest is black, and the shorter yellowish:[1] the throat, feet, and tail, are blacker than any other parts of the body; the claws are white underneath, and brown above; and its tail is about two inches and a half.

It is very destructive to young game of all kinds;[2] but the rabbit seems to be its favourite prey: a single polecat is often sufficient to destroy a whole warren; for, with that insatiable thirst for blood which is natural to all the weasel kind, it kills much more than it can devour; and I have seen twenty rabbits at a time taken out dead, which they had destroyed, and that by a wound which was hardly perceptible. Their size, however, which is so much larger than the weasel, renders their retreats near houses much more precarious; although I have seen them burrow near a village, so as scarcely to be extirpated. But, in general, they reside in woods or thick brakes, making holes under ground of about two yards deep, commonly ending among the roots of large trees, for greater security. In winter they frequent houses, and make a common practice of robbing the henroost and the dairy.

The polecat is particularly destructive among pigeons[3] when it gets into a dove-house; without making so much noise as the weasel, it does a great deal more mischief; it despatches each with a single wound in the head; and, after killing a great number, and satiating itself with their blood, it then begins to think of carrying them home. This it carefully performs, going and returning, and bringing them one by one to its hole; but if it should happen that the opening by which it got into the dove-house be not large enough for the body of the pigeon to get through, this mischievous creature contents itself with carrying away the heads, and makes a most delicious feast upon the brains.[4]

It is not less fond of honey; attacking the hives in winter, and forcing the bees away. It does not remove far from houses in winter, as its prey is not so easily found in the woods during that season. The female brings forth her young in summer, to the number of five or six at a time; these she soon trains to her own rapacious habits, supplying the want of milk, which no carnivorous quadruped has in plenty, with the blood of such animals as she happens to seize. The fur of this animal is considered as soft and warm; yet it is in less estimation than some of a much inferior kind, from its offensive smell, which can never be wholly removed or suppressed. The polecat

---

so that there, and in the adjoining cantons, they have become a literal pest, and it is next to impossible to preserve poultry from their ravages. It is an erroneous belief with these ignorant peasants that polecats will never destroy poultry in places where they reside, but extend their depredations to distant parts. This argument, however, although true, would but free them from those they foster, while they would suffer from the forays of those remote.

The skin of the polecat, when properly manufactured, is a valuable fur, and especially when taken in the winter. It is, however, a difficult process to free the skins from their fœtid and offensive odour.

Several of the old writers mention that the polecat will prey upon fish. The following confirmation of this fact is recorded in "Bewick's Quadrupeds:"—During a severe storm, one of these animals was traced in the snow, from the side of a rivulet to its hole at some distance from it: as it was observed to have made frequent trips, and as other marks were to be seen in the snow which could not easily be accounted for, it was thought a matter worthy of greater attention. Its hole was, accordingly, examined, the polecat taken, and eleven fine eels were discovered to be the fruit of its nocturnal excursions. The marks in the snow were found to have been made by the motion of the eels in the creature's mouth.

[1] Ray's Synopsis. [2] British Zoology, vol. i. p. 78.

[3] Buffon.

[4] A pigeon-house, surrounded with a wet ditch, will tend to preserve the pigeons; for beasts of prey naturally avoid water.

seems to be an inhabitant of the temperate climates,[1] scarcely any being found towards the north, and but very few in the warmer latitudes. The species appears to be confined in Europe, from Poland to Italy. It is certain that these animals are afraid of the cold, as they are often seen to come into houses in winter, and as their tracks are never found in the snow, near their retreats. It is probable, also, that they are afraid of heat, as they are but thinly scattered in the southern climates.

THE MARTIN.

(See Plate XII. fig. 32.)

The Martin is a larger animal than any of the former, being generally eighteen inches long, and the tail ten more. It differs from the polecat, in being about four or five inches longer; its tail also is longer in proportion, and more bushy at the end; its nose is flatter; its cry is sharper and more piercing; its colours are more elegant; and, what still adds to their beauty, its scent, very unlike the former, instead of being offensive, is considered as a most pleasing perfume. The martin, in short, is the most beautiful of all British beasts of prey; its head is small, and elegantly formed; its eyes lively; its ears are broad, rounded, and open; its back, its sides, and tail, are covered with a fine thick downy fur, with longer hair intermixed; the roots are ash colour, the middle of a bright chestnut, the points black; the head is brown, with a slight cast of red; the legs, and upper sides of the feet, are of a chocolate colour; the palms, or under sides, are covered with a thick down, like that of the body; the feet are broad, the claws white, large, and sharp, well adapted for the purposes of climbing, but, as in others of the weasel kind, incapable of being sheathed or unsheathed at pleasure; the throat and breast are white; the belly of the same colour with the back, but rather paler; the hair on the tail is very long, especially at the end, where it appears much thicker than near the insertion.

There is also a variety of this animal, called the *yellow-breasted martin*, which, in no respect, differs from the former, except that this has a yellow breast, whereas the other has a white one: the colour of the body also is darker; and, as it lives more among trees than the other martin, its fur is more valuable, beautiful, and glossy. The former of these Mr Buffon calls the *fouine;* the latter, simply the *martin;* and he supposes them to be a distinct species: but as they differ only in colour, it is unnecessary to embarrass history by a new distinction, where there is only so minute a difference.

Of all animals of the weasel kind, the martin is the most pleasing; all its motions show great grace, as well as agility; and there is scarcely an animal in our woods that will venture to oppose it. Quadrupeds five times as big are easily vanquished; the hare, the sheep, and even the wild cat itself, though much stronger, is not a match for the martin: and although carnivorous animals are not fond of engaging each other, yet the wild cat and the martin seldom meet without a combat. Gesner tells us of one of this kind that he kept tame, which was extremely playful and pretty; it went among the houses of the neighbourhood and always returned home when hungry: it was extremely fond of a dog that had been bred up with it, and used to play with it as cats are seen to play, lying on its back, and biting without anger or injury. That which was kept tame by Mr Buffon, was not quite so social; it was divested of its ferocity, but continued without attachment; and was still so wild as to be obliged to be held by a chain. Whenever a cat appeared, it prepared for war; and if any of the poultry came within its reach, it flew upon them with avidity. Though it was tied by the middle of the body, it frequently escaped: at first it returned after some hours, but without seeming pleased, and as if it only came to be fed: the next time it continued abroad longer; and, at last, went away without ever returning. It was a female, and was, when it went off, a year and a half old; and Mr Buffon supposes it to have gone in quest of the male. It ate every thing that was given it, except salad or herbs; and it was remarkably fond of honey. It was remarked that it drank often, and often slept for two days together; and that, in like manner, it was often two or three days without sleeping. Before it went to sleep, it drew itself up into a round shape, hid its head, and covered itself with its tail. When awake it was in continual agitation, and was obliged to be tied up, not less to prevent its attacking the poultry, than to hinder it from breaking whatever it came near, by the capricious wildness of its motions.

The yellow-breasted martin is much more common in France than in England; and yet even there this variety is much scarcer than that with the white breast. The latter keeps nearer houses and villages, to make its petty ravages among the sheep and the poultry, the other keeps in the woods, and leads in every respect a savage life, building its nest on the tops of trees, and living upon such animals as are entirely wild like itself. About nightfall it usually quits its solitude to seek its prey, hunts after squirrels, rats, and rabbits; destroys great numbers of birds and their young, takes the eggs from the nest, and often removes them to its own without breaking. The instant the martin finds itself pursued by dogs, for which purpose there is a peculiar breed, that seem fit for this chase only, it immediately makes to its retreat, which is generally in the hollow of some tree towards the top, and which it is impossible to come at without cutting it down. Their nest is generally the original tenement of the squirrel, which that little animal bestowed great pains in completing; but the martin having killed and dispossessed the little architect, takes possession of it for its own use, enlarges its dimensions, improves the softness of the bed, and in that retreat brings forth its young. Its litter is never above three or four at a time; they are brought forth with the eyes closed, as in all the rest of this kind, and very soon come to a state of perfection. The dam compensates for her own deficiency of milk, by bringing them eggs and live birds, accustoming them from the beginning to a life of carnage and rapine. When she leads them from the nest into the woods, the birds at once distinguish their enemies, and attend them, as we before observed of the fox, with all the marks of alarm and animosity. Wherever the martin conducts her young, a flock of small birds are seen threatening and insulting her, alarming every thicket, and often directing the hunter in his pursuit. The martin is more common in North America than in any part of Europe. These animals are found in all the northern parts of the world, from Siberia to China and Canada. In every country they are hunted for their furs, which are very valuable, and chiefly so when taken in the beginning of winter. The most esteemed part of the martin's skin is that part of it which is browner than the rest, and stretches along the backbone. Above twelve thousand of these skins are annually imported into England from Hudson's bay, and above thirty thousand from Canada.[1]

---

[1] Buffon.

THE SABLE.

Most of the classes of the weasel kind would have continued utterly unknown and disregarded, were it not for their furs, which are finer, more glossy, and soft, than those of any other quadruped. Their dispositions are fierce and untameable; their scent generally offensive; and their figure disproportioned and unpleasing. The knowledge of one or two of them would, therefore, have sufficed curiosity; and the rest would probably have been confounded together under one common name, as things useless and uninteresting, had not their skins been coveted by the vain, and considered as capable of adding to human magnificence or beauty.

Of all these, however, the skin of the sable is the most coveted, and held in the highest esteem. It is of a brownish black; and the darker it is it becomes the more valuable. A single skin, though not above four inches broad, is often valued at ten or fifteen pounds;[2] the fur differing from others in this, that it has no grain; so that rub it which way you will, it is equally smooth and unresisting. Nevertheless, though this little animal's robe was so much coveted by the great, its history till of late was but very little known; and we are obliged to Mr Jonelin for the first accurate description of its form and nature.[3] From him we learn that the sable resembles the martin in form and size, and the weasel in the number of its teeth; for it is to be observed, that whereas the martin has thirty-eight teeth, the weasel has but thirty-four; in this respect, therefore, the sable seems to make the shade between these two animals; being shaped like the one, and furnished with teeth like the other. It is also furnished with very large whiskers about the mouth; its feet are broad, and, as in the rest of its kind, furnished with five claws on each foot. These are its constant marks; but its fur, for which it is so much valued, is not always the same. Some of this species are of a dark brown over all the body, except the ears and the throat, where the hair is rather yellow; others are more of a yellowish tincture, their ears and throat being also much paler. These in both are the colours they have in winter, and which they are seen to change in the beginning of the spring; the former becoming of a yellow brown, and the latter of a pale yellow. In other respects they resemble their kind, in vivacity, agility, and inquietude; in sleeping by day, and seeking their prey by night; in living upon smaller animals; and in the disagreeable odour that chiefly characterizes their race.

---

[1] The Guinea martin is of a dark brown colour; its forehead white, and its neck with a long narrow stripe along the side. Its fur is sprinkled with black and white; its snout is long, and of a deep black colour; the crown is whitish grey, and the belly of a fine chestnut. The length of the body is in general nearly two feet, and the tail five inches.

The woolly martin inhabits Cayenne; the body is about sixteen inches long, and the tail nine. The snout is long and slender; the upper jaw is considerably longer than the lower; its ears are short and rounded, and its legs short and stout. The body is covered with wooly hair. and its tail is long and tapering.

[2] Regnard. [3] Buffon, vol. xxvii. p. 113.

They generally inhabit along the banks of rivers in shady places, and in the thickest woods. They leap with great ease from tree to tree, and are said to be afraid of the sun, which tarnishes the lustre of their robes. They are chiefly hunted in winter for their skins, during which part of the year they are only in season. They are mostly found in Siberia, and but very few in any other country of the world; and this scarcity it is which enhances their value. The hunting of the sable chiefly falls to the lot of the condemned criminals, who are sent from Russia into these wild and extensive forests, that for the greatest part of the year, are covered with snow; and in this instance, as in many others, the luxuries and ornaments of the vain, are wrought out of the dangers and the miseries of the wretched. These are obliged to furnish a certain number of skins every year, and are punished if the proper quantity be not provided.

The sable is also killed by the Russian soldiers, who are sent into those parts to that end. They are taxed a certain number of skins yearly, like the former, and are obliged to shoot with only a single ball, to avoid spoiling the skin, or else with crossbows and blunt arrows. As an encouragement to the hunters, they are allowed to share among themselves the surplus of those skins which they thus procure; and this, in the process of six or seven years, amounts to a very considerable sum. A colonel, during his seven years' stay, gains about four thousand crowns for his share, and the common men six or seven hundred each for theirs.

THE ICHNEUMON.

(*See Plate XIII. fig.* 19.)

The ichneumon, which some have injudiciously denominated the *cat of Pharaoh*, is one of the boldest and most useful animals of all the weasel kind. In the kingdom of Egypt, where it is chiefly bred, it is used for the same purposes that cats are in Europe, and is even more serviceable, as being more expert in catching mice than they. This animal is usually of the size of the martin, and greatly resembles it in appearance, except that the hair, which is of a grisly black, is much rougher, and less downy.[1] The tail, also, is not so bushy at the end; and each hair in particular has three or four colours, which are seen in different dispositions of its body. Under its rougher hairs, there is a softer fur of a brownish colour, the rough hair being about two inches long, but that of the muzzle extremely short, as likewise that on the legs and paws. However, being long since brought into a domestic state, there are many varieties in this animal; some being much larger than the martin, others much less; some being of a lighter mixture of colours, and some being streaked in the manner of a cat.

The ichneumon, with all the strength of a cat, has more instinct and agility; a more universal appetite for carnage, and a greater variety of powers to procure it.[2] Rats, mice, birds, serpents, lizards, and insects, are all equally pursued; it attacks every living thing which it is able to overcome, and indiscriminately preys on flesh of all kinds. Its courage is equal to the vehemence of its appetite. It fears neither the force of the dog, nor the insidious malice of the cat; neither the claws of the vulture, nor the poison of the viper. It makes war upon all kinds of serpents with great avidity, seizes and kills them, how venomous soever they be; and we are told, that when it begins to perceive the effects of their rage, it has recourse to a certain root, which the Indians call after its name, and assert to be an antidote for the bite of the asp or the viper.

But what this animal is particularly serviceable to the Egyptians for, is, that it discovers and destroys the eggs of the crocodile. It also kills the young ones that have not as yet been able to reach the water; and, as fable usually goes hand in hand with truth, it is said that the ichneumon sometimes enters the mouth of the crocodile, when it is found leeping on the shore, boldly attacks the enemy in the inside, and at length, when it has effectually destroyed it, eats its way out again.

---

[1] The ichneumon is of a brown colour, speckled with dirty white,—that is to say, that each hair has brown and white rings. The hairs are very short and the rings very small upon the head and the extremity of the members, which gives to these parts a deeper tint than the others. The white rings are larger, and the hairs are longer upon the back and the tail. Upon the flanks and under the belly the hairs become still longer, and the tint is paler than on the other parts. The tail is terminated by a tuft of very long black hairs, which contrast strongly with the fawn-brown of the rest of the body. The hair of the ichneumon is more thick, dry, and weak than in any other animal of the same genera. The length of the body, from the ears to the root of the tail, is one foot; the length of the head, from the back of the ears to the muzzle, is about three inches and a half; the length of the tail is one foot four inches; and the height of the most elevated part of the back is seven inches.

[2] The rest of this description is extracted from Mr Buffon, except where marked with commas.—*Goldsmith.*

The ichneumon, when wild, generally resides along the banks of rivers; and in times of inundation makes to the higher ground, often approaching inhabited places in quest of prey.[1] It goes forward silently and cautiously, changing its manner of moving according to its necessities. Sometimes it carries the head high, shortens its body, and raises itself upon its legs; sometimes it lengthens itself, and seems to creep along the ground; it is often observed to sit upon its hind legs like a dog when taught to beg; but more commonly it is seen to dart like an arrow upon its prey, and seize it with inevitable certainty. Its eyes are sprightly, and full of fire, its physiognomy sensible, its body nimble, its tail long, and its hair rough and various. Like all its kind, it has glands, that open behind, and furnish an odorous substance. Its nose is too sharp and its mouth too small to permit its seizing things that are large; however, it makes up by its courage and activity its want of arms; it easily strangles a cat, though stronger and larger than itself; and often fights with dogs, which, though never so bold, learn to dread the ichneumon as a formidable enemy. It also takes the water like an otter, and, as we are told, will continue under it much longer.

This animal grows fast, and dies soon. It is found in great numbers in all the southern parts of Asia, from Egypt to Java; and it is also found in Africa, particularly at the Cape of Good Hope. It is domestic, as was said, in Egypt, but in our colder climates it is not easy to breed or maintain them, as they are not able to support the rigour of out winters. Nevertheless, they take every precaution that instinct can dictate to keep themselves warm; they wrap themselves up into a ball, hiding the head between the legs, and in this manner continue to sleep all day long. "Seba had one sent him from the island of Ceylon, which he permitted to run for some months about the house. It was heavy and slothful by day, and often could not be awakened even with a blow; but it made up this indolence by its nocturnal activity, smelling about without either being wholly tame or wholly mischievous. It climbed up the walls and the trees with very great ease, and appeared extremely fond of spiders and worms, which it preferred, probably from their resemblance to serpents, its most natural food. It was also particularly eager to scratch up holes in the ground; and this, added to its wildness and uncleanliness, obliged our naturalist to smother it in spirits, in order to preserve, and add it to the rest of his collection."

This animal was one of those formerly worshipped by the Egyptians, who considered every thing that was serviceable to them as an emanation of the Deity, and worshipped such as the best representatives of God below. Indeed, if we consider the number of eggs which the crocodile lays in the sand at a time, which often amount to three or four hundred, we have reason to admire this little animal's usefulness as well as industry in destroying them, since otherwise the crocodile might be produced in sufficient numbers to overrun the whole earth.

THE STINKARDS.

This is a name which our sailors give to one or two animals of the weasel kind, which are chiefly found in America. All the weasel kind, as was already observed, have a very strong smell; some of them indeed approaching to a perfume, but the greatest number most insupportably fœtid. But the smell of our weasels, and ermines, and polecats, is fragrance itself when compared to that of the *squash* and the *skink*, which have been called the *polecats* of America.[2] These two are found in different parts of America, both differing in colour and fur, but both obviously of the weasel kind, as appears not only from their figure and odour, but also from their disposition. The squash is about the size of a polecat, its hair of a deep brown, but principally differing from all of this kind in having only four toes on the feet before, whereas all the other weasels have five. The skink, [or skunk: see Plate XII. fig. 33.] which I take to be Catesby's Virginia polecat, resembles a polecat in shape and size, but particularly differs in the length of its hair and colour. The hair is above three inches and a half long, and that at the end of the tail above four inches. The colour is partly black and partly white, variously disposed over the body, very glossy, long, and beautiful. There seem to be two varieties more of this animal, which Mr Buffon calls the *conepate* and the *zorille*. He supposes each to be a distinct species: but as they are both said to resemble the polecat in form, and both to be clothed with a long fur of a black and white colour, it seems needless to make a distinction. The conepate resembles the skink in all things except in size, being smaller, and in the disposition of its colours, which are more exact, having five white stripes upon a black ground, running longitudinally from the head to the tail. The zorille resembles the skink, but is rather smaller, and more beautifully coloured, its streaks of black and white being more distinct, and the colours of its tail being black at its insertion and white at the extremity; whereas in the skink they are all of one gray colour.

---

[1] The ichneumon exercises much perseverance in obtaining his prey. He is seen to remain for hours in the same place, watching for the animal he has seen there, and which he endeavours to obtain. This quality makes him a valuable substitute for the cat, in cleaning a house of the parasitical little animals that infest it, and he is for this reason domesticated. He is much attached, in a domestic state, to the house he inhabits, and remains affectionate and submissive to those who have brought him up. He does not ramble, and has no temptation to return to his wild state; but, when lost, he seeks the persons he has often seen, whose voices he recognizes, and whose caresses he loves. But this gentle creature loses much of his mildness when he eats. He then seeks out some secret retreat and manifests great choler if he sees any cause to fear being deprived of his prey. When he penetrates to a place which is unknown to him, he immediately explores it in every part, chiefly by his sense of smell, which of all his organs seems the most active and delicate, on which he appears to rely the most, and which seems in some measure to compensate for the feebleness of the others.

[2] Audubon tells an amusing story of a gentleman, who travelled in company with him from Louisiana to Henderson, mistaking one of these animals, which they met with on the road, for a squirrel; and attempting to secure it, when, raising "its fine bushy tail, it showered such a discharge of the fluid given by nature as a defence, that my friend, dismayed and infuriated, began to belabour the poor animal. The swiftness and good management of the polecat, however, saved its bones; and, as it made good its retreat towards its hole, it kept up at every step a continual ejectment, which fully convinced the gentleman that the pursuit of such animals as these was at best an unprofitable employment. This was not all, however. I could not suffer his approach, nor could my horse: it was with difficulty he mounted his own, and we were forced to continue our journey far asunder, and he much to leeward." A cloak, which received the fluid in most abundance, continued a source of sad annoyance. While frozen (for it was winter) it did not give out any odour, but when thawed, or brought near the fire, it was intolerable. Some years afterwards, says Audubon, "I met my Kentucky companion in a

But whatever differences there may be in the figure or colour of these little animals, they all agree in one common affection, that of being intolerably fœtid and lothesome. I have already observed that all the weasel kind have glands furnishing an odorous matter, near the anus, the conduits of which generally have their aperture just at its opening. That substance which is stored up in these receptacles, is in some of this kind, such as in the martin already mentioned, and also in the genet and the civet to be described hereafter, a most grateful perfume; but in the weasel, the ermine, the ferret, and the polecat, it is extremely fœtid and offensive. These glands in the animals now under consideration are much larger, and furnish a matter sublimed to a degree of putrescence that is truly amazing. As to the perfumes of musk and civet, we know that a single grain will diffuse itself over a whole house, and continue for months to spread an agreeable odour, without diminution. However, the perfume of the musk or the civet is nothing, either for strength or duration, to the insupportable odour of these. It is usually voided with their excrement; and if but a single drop happens to touch any part of a man's garment, it is more than probable that he can never wear any part of it more.

In describing the effects produced by the excrement of these animals, we often hear of its raising this diabolical smell by its urine. However, of this I am apt to doubt; and it should seem to me, that, as the weasel kind have their excrements so extremely fœtid from the cause above mentioned, we may consider these also as being fœtid from the same causes. Besides, they are not furnished with glands to give their urine such a smell; and the analogy between them and the weasel kind being so strong in other respects, we may suppose they resemble each other in this. It has also been said, that they take this method of ejecting their excrement to defend themselves against their pursuers; but it is much more probable, that this ejection is the convulsive effect of terror, and that it serves as their defence without their own concurrence. Certain it is, that they never smell thus horridly except when enraged or affrighted, for they are often kept tame about the houses of the planters of America without being very offensive.

The habitudes of these animals are the same, living like all the rest of the weasel kind, as they prey upon smaller birds and bird's eggs. The squash, for instance, burrows like the pole-cat in the clefts of rocks, where it brings forth its young. It often steals into farm yards, and kills the poultry, eating only their brains. Nor is it safe to pursue or offend it, for then it calls up all its

---

far-distant land, when he assured me that, whenever the sun shone on his cloak, or it was brought near a fire, the scent of the polecat became so perceptible, that he at last gave it to a poor monk in Italy."

The following is Audubon's description of the skunk or polecat:—The animal "is about a foot and a half in length, with a large bushy tail, nearly as long as the body. The colour is generally brownish black, with a large white patch on the back of the head; but there are many varieties of colouring, in some of which the broad white bands of the back are very conspicuous. The polecat burrows, or forms a subterranean habitation among the roots of trees, or in rocky places. It feeds on birds, young hares, rats, mice, and other animals, and commits great depredations on poultry. The most remarkable peculiarity of this animal is the power of squirting, for its defence, a most nauseously-scented fluid, contained in a receptacle situated under the tail, which it can do to the distance of several yards. It does not, however, for this purpose, sprinkle its tail with the fluid, as some allege, unless when extremely harassed by its enemies. The polecat is frequently domesticated. The removal of the glands prevents the secretion of the nauseous fluid; and when thus improved, the animal becomes a great favourite, and performs the offices of the common cat with great dexterity."

scents, which are its most powerful protection. At that time neither men nor dogs will offer to approach it; the scent is so strong that it reaches for half a mile round, and more near at hand is almost stifling. If the dogs continue to pursue, it does all in its power to escape, by getting up a tree, or by some such means; but if driven to an extremity, it then lets fly upon the hunters, and if it should happen that a drop of this fœtid discharge falls in the eye, the person runs the risk of being blinded for ever.

The dogs themselves instantly abate of their ardour when they find this extraordinary battery played off against them; they instantly turn tail, and leave the animal undisputed master of the field; and no exhortations can ever bring them to rally. "In the year 1749," says Kalm, "one of these animals came near the farm where I lived. It was in winter time, during the night; and the dogs that were upon the watch pursued it for some time, until it discharged against them.[1] Although I was in my bed a good way off, I thought I should have been suffocated; and the cows and oxen, by their lowings, showed how much they were affected by the stench. About the end of the same year, another of these animals crept into our cellar, but did not exhale the smallest scent because it was not disturbed. A foolish woman, however, who perceived it at night, by the shining of its eyes, killed it, and at that moment its stench began to spread. The whole cellar was filled with it to such a degree, that the woman kept her bed for several days after, and all the bread, meat, and other provisions that were kept there, were so infected, that they were obliged to be thrown out of doors." Nevertheless, many of the planters and native Americans keep this animal tame about their houses; and seldom perceive any disagreeable scents, except it is injured or frighted. They are also known to eat its flesh, which some assert to be tolerable food; however, they take care to deprive it of those glands which are so horribly offensive.

THE GENET.

From the squash, which is the most offensive animal in nature, we come to the genet, which is one of the most beautiful and pleasing. Instead of the horrid stench, with which the former affects us, this has a most grateful odour: more faint than civet, but to some for that reason more agreeable. This animal is rather less than the martin; though there are genets of different sizes, and I have seen one rather larger. It also differs somewhat in the form of its body. It is not easy in words to give an idea of the distinction. It resembles all those of the weasel kind in its length, compared to its height; it resembles them in having a soft beautiful fur, in having its feet armed with claws that cannot be sheathed, and in its appetite for petty carnage. But then it differs from them in having the nose much smaller and longer, rather resembling that of a fox than a weasel. The tail, also, instead of being bushy, tapers to a point, and is much longer, its ears are larger, and its paws smaller. As to its colours and figure in general, the genet is spotted with black, upon a ground mixed with red and gray. It has two sorts of hair, the one shorter and softer, the other longer and stronger, but not above half an inch long on any part of its body except the tail. Its spots are distinct and separate upon the sides, but unite towards the back, and form black stripes, which run longitudinally from the neck backwards. It has also along the back a kind of mane or longish hair, which forms a black streak from the head to the tail, which last is marked with rings, alternately black and white its whole length.

The genet, like all the rest of the weasel kinds, has glands, that separate a kind of perfume, resembling civet, but which soon flies off. These glands open differently from those of other animals of this kind; for as the latter have their aperture just at the opening of the anus, these have their aperture immediately under it; so that the male seems, for this reason, to the superficial observer, to be of two sexes.

It resembles the martin very much in its habits and disposition;[2] except that it seems tamed much more easily. Belonius assures us, that he has seen them in the houses at Constantinople as tame as cats; and that they were permitted to run every where about, without doing the least mischief. For this reason they have been called the *cats of Constantinople;* although they have little else in common with that animal, except their skill in spying out and destroying vermin. Naturalists pretend that it inhabits only the moister grounds, and chiefly resides along the banks of rivers, having never been found in mountains, nor dry places. The species is not much diffused; it is not to be found in any part of Europe, except Spain and Turkey; it requires a warm climate to subsist and multiply in; and yet it is not to be found in the warmer regions either of India, or Africa. From such as have seen its uses at Constantinople, I learn that it is one of the most beautiful, cleanly, and industrious animals in the world; that it keeps whatever house it is in perfectly free from mice and rats, which cannot endure its smell. Add to this, its nature is mild and gentle, its colours various and glossy, its fur valuable; and, upon the whole, it seems to be one of those animals that with proper care might be propagated amongst us, and might become one of the most serviceable of our domestics.

---

[1] Voyage de Kalm, as quoted by Buffon, vol. xxvii. p. 93.

[2] Buffon, vol. xix. p. 187.

THE CIVET.

(*See Plate XII. fig.* 36.)

Proceeding from the smaller to the greater of this kind, we come in the last place to the civet, which is much larger than any of the former; for as the martin is not above sixteen inches long, the civet is found to be above thirty. Mr Buffon distinguishes this species into two kinds, one of which he calls the *civet*, and the other the *zibet*. The latter principally differs from the former in having the body longer and more slender, the nose smaller, the ears longer and broader; no mane or long hair running down the back in the latter; and the tail longer, and better marked with rings of different colours, from one end to the other. These are the differences which have induced this great naturalist to suppose them animals of distinct species; and to allot each a separate description. How far future experience may confirm this conjecture, time must discover; but certain it is, that if such small varieties make a separate species, there may be many other animals equally entitled to peculiar distinction that are now classed together. We shall, therefore, content ourselves, at present, with considering, as former naturalists have done, these two merely as varieties of the same animal, and only altered in figure by climate, food, or education.

The civet resembles animals of the weasel kind in the long slenderness of its body, the shortness of its legs, the odorous matter that exudes from the glands behind, the softness of its fur, the number of its claws, and their incapacity of being sheathed. It differs from them in being much larger than any hitherto described; in having the nose lengthened, so as to resemble that of the fox; the tail long and tapering to a point; and its ears straight, like those of a cat. The colour of the civet varies: it is commonly ash, spotted with black; though it is whiter in the female, tending to yellow; and the spots are much larger, like those of a panther. The colour on the belly, and under the throat, is black; whereas the other parts of the body are black or streaked with gray. This animal varies in its colour, being sometimes streaked, as in our kind of cats called *tabbies*. It has whiskers like the rest of its kind; and its eye is black and beautiful.

The opening of the pouch or bag, which is the receptacle of the civet, differs from that of the rest of the weasel kind, not opening into, but under the anus. Besides this opening, which is large, there is still another lower down; but for what purposes designed is not known. The pouch itself is about two inches and a half broad, and two long; its opening makes a chink from the top downwards, that is about two inches and a half long; and is covered on the edges and within, with short hair: when the two sides are drawn asunder, the inward cavity may be seen, large enough to hold a small pullet's egg; all round this are small glands, opening and furnishing that strong perfume which is so well known, and is found in this pouch of the colour and consistence of pomatum. Those who make it their business to breed these animals for their perfume, usually take it from them twice or thrice a-week, and sometimes oftener. The animal is kept in a long sort of a box, in which it cannot turn round. The person, therefore, opens this box behind, drags the animal backwards by the tail, keeps it in this position by a bar before, and, with a wooden spoon, takes the civet from the pouch as carefully as he can; then lets the tail go, and shuts the box again. The perfume thus procured, is put into a vessel, which he takes care to keep shut; and when a sufficient quantity is procured, it is sold to very great advantage.

The civet,[1] although a native of the warmest climates, is yet found to live in temperate, and even cold countries, provided it be defended carefully from the injuries of the air. Wherefore, it is not only bred among the Turks, the Indians, and Africans, but great numbers of these animals are also bred in Holland, where this scraping people make no small gain of its perfume. The perfume of Amsterdam is reckoned the purest of any; the people of other countries adulterating it with gums, and other matters, which diminish its value, but increase its weight. The quantity which a single animal affords, generally depends upon its health and nourishment. It gives more in proportion as it is more delicately and abundantly fed. Raw flesh hashed small, eggs, rice, birds, young fowls, and particularly fish, are the kinds of food the civet most delights in. These are to be changed and altered, to suit and entice its appetite, and continue its health. It gets but very little water; and although it drinks but rarely, yet it makes urine very frequently; and, upon such occasions, we cannot, as in other animals, distinguish the male from the female.

---

[1] Buffon, vol. xix.

The perfume of the civet is so strong that it communicates itself to all parts of the animal's body; the fur is impregnated thereby, and the skin penetrated to such a degree that it continues to preserve the odour for a long time after it is stripped off. If a person be shut up with one of them in a close room, he cannot support the perfume, which is so copiously diffused. When the animal is irritated, as in all the weasel kind, its scent is much more violent than ordinary; and if it be tormented so as to make it sweat, this also is a strong perfume, and serves to adulterate or increase what is otherwise obtained from it. In general, it is sold in Holland for about fifty shillings an ounce; although, like all other commodities, its value alters in proportion to the demand. Civet must be chosen new, of a good consistence, a whitish colour, and a strong disagreeable smell. There is still a very considerable traffic carried on from Bussorah, Calicut, and other places in India, where the animal that produces it is bred; from the Levant also, from Guinea, and especially from Brazil in South America, although Mr Buffon is of opinion that the animal is a native only of the Old Continent, and not to be found wild in the New. The best civet, however, is furnished, as was observed, by the Dutch, though not in such quantities at present as some years past, when this perfume was more in fashion. Civet is a much more grateful perfume than musk, to which it has some resemblance; and was some years ago used for the same purposes in medicine. But, at present, it is quite discontinued in prescription; and persons of taste or elegance seem to proscribe it even from the toilet. Perfumes, like dress, have their vicissitudes; musk was in peculiar repute, until displaced by civet; both gave ground, upon discovering the manner of preparing ambergrise; and even this is now disused for the less powerful vegetable kinds of fragrance, spirit of lavender or ottar of roses.

As to the rest, the civet is said to be a wild fierce animal; and, although sometimes tamed, is never thoroughly familiar. Its teeth are strong and cutting, although its claws be feeble and flexible. It is light and active, and lives by prey, as the rest of its kind, pursuing birds, and other small animals that it is able to overcome. They are sometimes seen stealing into the yards and outhouses, to seize upon the poultry; their eyes shine in the night, and it is very probable that they see better in the dark than by day. When they fail of animal food, they are found to subsist upon roots and fruits, and very seldom drink; for which reason they are never found near great waters. They breed very fast in their native climates, where the heat seems to conduce to their propagation, but in our temperate latitudes, although they furnish their perfume in great quantities, yet they are not found to multiply; a proof that their perfume has no analogy with their appetite for generation.

THE GLUTTON.[1]

(*See Plate XII. fig.* 31.)

I will add but one animal more to this numerous class of the weasel kind; namely, the glutton; which, for several reasons, seems to belong to this tribe, and this only. We have hitherto had no precise description of this quadruped; some resembling it to a badger, some to a fox, and some to a hyæna. Linnæus places it among the weasels, from the similitude of its teeth; it should seem to me to resemble this animal still more, from the great length of its body, and the shortness of its legs, from the softness of its fur, its disagreeable scent, and its insatiable appetite for animal food. Mr Klein, who saw one of them, which was brought alive from Siberia, assures us, that it was about three feet long,[2] and about a foot and a half high. If we may compare these dimensions with those of other animals, we shall find that they approach more nearly to the class we are at present describing than any other; and that the glutton may very justly be conceived under the form of a great overgrown weasel. Its nose, its ears, its teeth, and its long bushy tail, are entirely similar; and as to what is said of its being rather corpulent than slender, it is most probable that those who described it thus, saw it after eating, at which time its belly, we are assured, is most monstrously distended: however, suspending all certainty upon this subject, I will take leave rather to follow Linnæus than Buffon, in describing this animal; and leave future experience to judge between them.

---

[1] The glutton (*Gulo Luscus*) is a native of the northern regions, both of the old and the new world. It is found in Sweden, Russia, and Siberia, as well as in the northern parts of America, from the coasts of Labrador and Davis' Straits to the shores of the Pacific; and it even visits the islands of the polar Sea, its bones having been found in Melville Island, nearly in latitude 75°.

Its general appearance is that of a bear in miniature; its head is broad and compact, and rounded off on every side to form the nose. The ears are short and rounded, and almost hidden among the fur; the back is arched, the tail short and bushy, the limbs thick, short, and very muscular: the whole contour of the animal indicates vast strength, but only a small share of activity. In walking, the glutton places the entire sole of the feet on the ground, and imprints a track on the snow or soft earth so like that of a bear that it may be easily mistaken for it. The Indians, however, at once distinguish the tracks by the length of the steps. The general colour of the fur, which is long and full, and much like that of a black bear, is dark brown, a paler band passing along each side, and uniting on the crupper; there are also a few irregular whitish markings on the throat and chest. The length of the head and body is two feet six inches; of the tail (with its fur) ten inches.

[2] He says, it was an ell and eight inches long: I have, therefore, given its length, as supposing it to be a Flemish ell, which is twenty-seven inches.—*Goldsmith.*

The glutton, which is so called from its voracious appetite, is an animal found as well in the north of Europe and Siberia, as in the northern parts of America, where it has the name of the *carcajou*. Amidst the variety of descriptions which have been given of it, no very just idea can be formed of its figure; and, indeed, some naturalists, among whom was Ray, entirely doubted of its existence. From the best accounts, however, we have of it, the body is thick and long, the legs short; it is black along the back, and of a reddish brown on the sides; its fur is held in the highest estimation, for its softness and beautiful gloss; the tail is bushy, like that of the weasel, but rather shorter; and its legs and claws are better fitted for climbing trees, than for running along the ground. Thus far it entirely resembles the weasel; and its manner of taking its prey is also by surprise, and not by pursuit.

Scarcely any of the animals with short legs and long bodies pursue their prey; but, knowing their own incapacity to overtake it by swiftness, either creep upon it in its retreats, or wait in ambush and seize it with a bound. The glutton, from the make of its legs and the length of its body, must be particularly slow; and, consequently, its only resource is in taking its prey by surprise. All the rest of the weasel kind, from the smallness of their size, are better fitted for a life of insidious rapine than this; they can pursue their prey into its retreats, they can lurk unseen among the branches of trees, and hide themselves with ease under the leaves: but the glutton is too large to follow small prey into their retreats; nor would such, even if obtained, be sufficient to sustain it. For these reasons, therefore, this animal seems naturally compelled to the life for which it has long been remarkable. Its only resource is to climb a tree, which it does with great ease, and there it waits with patience until some large animal passes underneath, upon which it darts down with unerring certainty, and destroys it.[1]

It is chiefly in North America that this voracious creature is seen lurking among the thick branches of trees, in order to surprise the deer, with which the extensive forests of that part of the world abound. Endued with a degree of patience equal to its rapacity, the glutton singles out such trees as it observes marked by the teeth or the antlers of the deer; and is known to remain there watching for several days together. If it has fixed upon a wrong tree, and finds that the deer have either left that part of the country, or cautiously shun the place, it reluctantly descends, pursues the beaver to its retreat, or even ventures into the water in pursuit of fishes. But if it happens that, by long attention and keeping close, at last the elk or the rein-deer happen to pass that way, it at once darts upon them, sticks its claws between their shoulders, and remains there unalterably firm. It is in vain that the large frighted animal increases its speed, or threatens with its branching horns; the glutton having taken possession of its post, nothing can drive it off; its enormous prey drives rapidly along amongst the thickest woods, rubs itself against the largest trees, and tears down the branches with its expanded horns; but still its insatiable foe sticks behind, eating its neck, and digging its passage to the great blood-vessels that lie in that part. Travellers who wander through those deserts, often see pieces of the glutton's skin sticking to the trees, against which it was rubbed by the deer. But the animal's voracity is greater than its feelings, and it never seizes without bringing down its prey. When, therefore, the deer, wounded and feeble with the loss of blood, falls, the glutton is seen to make up for its former abstinence by its present voracity. As it is not possessed of a feast of this kind every day, it resolves to lay in a store to serve it for a good while to come. It is, indeed, amazing how much one of these animals can eat at a time! That which was seen by Mr Klein, although without exercise or air, although taken from its native climate, and enjoying but an indifferent state of health, was yet seen to eat thirteen pounds of flesh every day, and yet remain unsatisfied. We may, therefore, easily conceive how much more it must devour at once, after a long fast, of a food of its own procuring, and in the climate most natural to its constitution. We are told, accordingly, that from being a lank, thin animal, which it naturally is, it then gorges in such quantities, that its belly is distended, and its whole figure seems to alter. Thus voraciously it continues eating, till, incapable of any other animal function, it lies totally torpid by the animal it has killed: and in this situation continues for two or three days. In this lothesome and helpless state, it finds its chief protection from its horrid smell, which few animals care to come near;[1] so that it continues eating and sleeping till its prey be devoured, bones and all, and then it mounts a tree, in quest of another adventure.

---

[1] With respect to the stratagem so universally attributed to the glutton of lurking on the branches of moss-grown trees, and even of enticing the rein-deer to approach by throwing down the lichen on which this animal feeds, Dr Richardson observes, that it is not resorted to by the American wolverene, and he appears to disbelieve the account. Desmarest, however, adopts it as an authenticated fact, relying on the authority of the early writers. There are probably some details connected with this belief which would explain its apparent exaggeration. That the glutton may steal upon the rein-deer asleep, or attack weak or dying deer, or young fawns, is very probable; but that it is capable of such artifice and address as are implied in the account alluded to, requires to be better authenticated before it can be received as truth. When attacked by other animals the glutton fights desperately, and three stout dogs are said to be scarcely its match. Isbrand says, that a Waivode, who kept one tame, threw it one day into the water, and set upon it a couple of dogs, when it immediately seized one by the head and held it under water till it was drowned. It does not, however, defend itself so energetically against man, from whose presence it usually endeavours to escape, and is easily dispatched by a hunter with no other weapon than a stick.

The glutton, like many others of the weasel kind, seems to prefer the most putrid flesh to that newly killed; and such is the voraciousness of this hateful creature, that, if its swiftness and strength were equal to its rapacity, it would soon thin the forest of every other living creature. But, fortunately, it is so slow, that there is scarcely a quadruped that cannot escape it, except the beaver. This, therefore, it very frequently pursues upon land; but the beaver generally makes good its retreat by taking to the water, where the glutton has no chance to succeed. This pursuit only happens in summer; for in the winter all that remains is to attack the beaver's house, as at that time it never stirs from home. This attack, however, seldom succeeds; for the beaver has a covert way bored under the ice, and the glutton has only the trouble and disappointment of sacking an empty town.

A life of necessity generally produces a good fertile invention. The glutton, continually pressed by the call of appetite, and having neither swiftness nor activity to satisfy it, is obliged to make up by stratagem the defects of nature. It is often seen to examine the traps and the snares laid for other animals, in order to anticipate the fowlers.[2] It is said to practise a thousand arts to procure its prey, to steal upon the retreats of the rein-deer, the flesh of which animal it loves in preference to all others; to lie in wait for such animals as have been maimed by the hunters; to pursue the isatis while it is hunting for itself; and when that animal has run down its prey, to come in and seize upon the whole, and sometimes to devour even its poor provider; and when these pursuits fail, even to dig up the graves, and fall upon the bodies interred there, devouring them bones and all. For these reasons, the natives of the countries where the glutton inhabits, hold it in utter detestation, and usually term it the vulture of quadrupeds. And yet it is extraordinary enough, that being so very obnoxious to man it does not seem to fear him. We are told by Gmelin of one of those coming up boldly and calmly where there were several persons at work, without testifying the smallest apprehension, or attempting to run, until it had received several blows, that at last totally disabled it. In all probability it came among them seeking its prey; and, having been used to attack animals of inferior strength, it had no idea of a force superior to its own. The glutton, like all the rest of its kind, is a solitary animal, and is never seen in company except with its female, with which it couples in the midst of winter. The latter goes with young about four months, and brings forth two or three at a time.[3] They burrow in holes as the weasel; and the male and female are generally found together, both equally resolute in defence of their young. Upon this occasion the boldest dogs are afraid to approach them; they fight obstinately, and bite most cruelly. However, as they are unable to escape by flight, the hunters come to the assistance of the dogs, and easily overpower them. Their flesh, it may readily be supposed, is not fit to be eaten, but the skins amply recompense the hunters for their toil and danger. The fur has the most beautiful lustre that can be imagined, and is preferred before all others except the Siberian fox, or the sable. Among other peculiarities of this animal Linnæus informs us, that it is very difficult to be skinned; but from what cause, whether its abominable stench, or the skin's tenacity to the flesh, he has not thought fit to inform us.

---

[1] Linnæi Systema, p. 67.

[2] The glutton visits the traps and snares of the fur-hunters of Siberia, for the sake of the animals taken in them; and the hunters of the isatis (*Cossac fox*) complain bitterly of the mischief which the glutton does. This tallies with the account of Dr Richardson, who, in allusion to the glutton, or wolverene, of the northern regions of America, says, that it is "a carnivorous animal, which feeds chiefly upon the carcases of beasts that have been killed by accident. It has great strength, and annoys the natives by destroying their hoards of provision, and demolishing their martin-traps. It is so suspicious that it will seldom enter a trap itself, but, beginning behind, pulls it to pieces, scatters the logs of which it is built, and then carries off the bait. It feeds also on meadow-mice, marmots, and other *Rodentia*, and occasionally, on *disabled quadrupeds* of a larger size. I have seen one chasing an American hare, which was at the same harassed by a snowy owl. It resembles the bear in its gait, and is not fleet, but it is very industrious, and no doubt feeds well, as it is generally fat. It is much abroad in the winter, and the track of its journey, in a single night, may often be traced for many miles."

[3] Linnæi Systema, p. 66

A

HISTORY OF ANIMALS.

BOOK V.

ANIMALS OF THE HARE KIND.

INTRODUCTION.

Having described in the last chapter a tribe of a minute, fierce, rapacious animals, I come now to a race of minute animals of a more harmless and gentle kind, that, without being enemies to any, are preyed upon by all. As Nature has fitted the former for hostility, so it has entirely formed the latter for evasion; and as the one kind subsist by their courage and activity, so the other find safety from their swiftness and their fears. The hare is the swiftest animal in the world for the time it continues; and few quadrupeds can overtake even the rabbit, when it has but a short way to run. To this class also we may add the squirrel, somewhat resembling the hare and rabbit in its form and nature, and equally pretty, inoffensive, and pleasing.

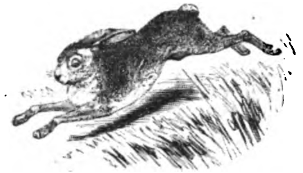
If we were methodically to distinguish animals of the hare kind from all others, we might say that they have but two cutting teeth above and two below, that they are covered with a soft downy fur, and that they have a bushy tail. The combination of these marks might perhaps distinguish them tolerably well, whether from the rat, the beaver, the otter, or any other most nearly approaching in form. But, as I have declined all method that rather tends to embarrass history than enlighten it, I am contented to class these animals together for no very precise reason, but because I find a general resemblance between them in their natural habits, and in the shape of their heads and body. I call a squirrel an animal of the hare kind, because it is something like a hare. I call the paca of the same kind, merely because it is more like a rabbit than any other animal I know of. In short, it is fit to erect some particular standard in the imagination of the reader, to refer him to some animal that he knows, in order to direct him in conceiving the figure of such as he does not know. Still, however, he should be apprised that his knowledge will be defective without an examination of each particular species; and that saying an animal is of this or that particular kind, is but a very trifling part of its history.

Animals of the hare kind, like all others that feed entirely upon vegetables, are inoffensive and timorous.[1] As nature furnishes them with a most abundant supply, they have not that rapacity after food remarkable in such as are often stinted in their provision. They are extremely active and amazingly swift, to which they chiefly owe their protection; for being the prey of every voracious animal, they are incessantly pursued. The hare, the rabbit, and the squirrel, are placed by Pyer ius, in his Treatise of Ruminating Animals, among the number of those that chew the cud; but how far this may be true I will not pretend to determine. Certain it is that their lips continually move whether sleeping or waking. Nevertheless they chew their meat very much before they swallow it, and for that reason I should suppose that it does not want a second mastication. All these animals use their fore-paws like hands; they are remarkably salacious, and are furnished by Nature with more ample powers than most others for the business of propagation. They are so very prolific, that were they not thinned by the constant depredations made upon them by most other animals, they would quickly overrun the earth.

---

[1] All the species of hare are alike under the continued influence of fear, and as their eyes are presumed not to be perfect during daylight, and their lateral direction prevents the animal seeing directly forward, they rather rely on their hearing, the organ of which is very perfect, to warn them of approaching danger. Perfectly defenceless, indeed, and exposed to countless enemies, they have no chance of safety but in the expedition of their flight, and unless forewarned by the acuteness of one or more of their senses, of the approach of an enemy, they would invariably fall the victim of surprise.

THE HARE.



Of all these the hare is the largest, the most persecuted, and the most timorous; all its muscles are formed for swiftness; and all its senses seem only given to direct its flight. It has very large prominent eyes, placed backwards in its head, so that it can almost see behind it as it runs. These are never wholly closed; but as the animal is continually upon the watch, it sleeps with them open. The ears are still more remarkable for their size; they are moveable, and capable of being directed to every quarter; so that the smallest sounds are readily received, and the animal's motions directed accordingly. The muscles of the body are very strong, and without fat, so that it may be said to carry no superfluous burden of flesh about it; the hinder feet are longer than the fore, which still adds to the rapidity of its motions; and almost all animals that are remarkable for their speed, except the horse, are formed in the same manner.

An animal so well formed for a life of escape,

---

[1] The genus Lepus, which includes the animals designated in common language by the names of Hares and Rabbits, is characterized by a peculiarity in the incisors of the upper jaw, which have behind them two smaller teeth nearly of the same form; by the flattened summits and transversely disposed plates of enamel of the grinders, of which there are six above and five below on each side, by a tuft of hairs on the inside of the cheeks; by the elongation of the ears, and the abbreviation and recurvature of the tail. Three species occur in Britain, and another is peculiar to Ireland.

The *Common Hare* of this country and of the continent of Europe, *Lepus timidus* of Linnæus, presents the following characters: The body is large, compressed, and deep; the neck very short; the head of moderate size, convex above, broad and obtuse in front, the nose being depressed, the lips tumid, and separated by a deep incision; the eyes very large, prominent, and situated laterally; the ears of the same length as the head, narrow, deeply concave, with the tip rounded. The hind limbs are much longer, and have only four toes, while there are five on the anterior; the soles of all are covered with hair; the claws rather long, slightly arched, compressed, rather acute, but those of the hind feet blunted in older individuals. The tail is very short and recurved. The fur is of two kinds, as in all the species of this genus; the longer hairs are very slender at the base, enlarged towards the end, acuminate and recurved, and intermixed with still longer straight hairs; the shorter extremely fine and tortuous. On the feet the longer hairs predominate, and are straightish, adpressed, and rather stiff; on the ears they are short; on the nape wanting. The mystachial bristles are long, faintly undulated on two opposite sides, disposed in several series, the lower forming a tuft; five or six long bristles arise over the eye; and there are some shorter beneath it. The hair on the lower parts is longer, on the tail soft and woolly. The fore part of the mouth within is covered with stiffish woolly hairs. The upper parts are light yellowish-brown, mingled with dusky on the back and sides, and with grey on the hind quarters; the fore part of the neck, and a portion of the breast, are dull light yellowish-red, as are the feet, and part of the flanks; the abdomen, inside of the thighs, and a large patch on the throat, are white; there is a whitish line over the eye, and a patch of greyish-white before it; the ears are pale yellowish-red on their anterior margin externally, dusky, intermixed with yellowish-red, on their anterior half, whitish on the posterior, with a patch of black at the end; internally with whitish hairs at the base, dusky at the middle of their posterior margin, reddish-white in the rest of their extent, excepting the margin of the tip, which is black. The tail is black above or anteriorly, white beneath, or rather behind, as it is recurved. On the upper parts the hair is greyish-white, sometimes pure white, at the base, dusky beyond the middle, and yellowish-brown at the end; the elongated slender hairs are black, but on the sides of the body and the lower parts reddish or white. The fur or fine hairs white, with the extremity dusky.

Length to end of tail	26	Inches.
— of head	5	—
— of tail	3½	—
— of ears	4	—
— from olecranon to end of middle claw	8	—
— from heel to end of second claw	5½	—

The common hare is generally distributed in Britain, but does not occur in Ireland, where, however, another species of nearly the same size is found. It feeds entirely on vegetable substances, such as grass, clover, corn, turnips, and the bark of young trees, sometimes inflicting great injury on the latter, especially in winter. Towards evening it comes abroad in quest of food, and continues to search for it during the night, in conformity with which habit its pupil is large, and of an oblong form. It advances by leaps, and as its hind legs are much longer than the anterior, it runs with more ease up an inclined plane than down a declivity, especially if it be steep. During the day it reposes in a crouching or half sitting posture in its form, which is a selected spot usually resorted to by it, among grass or ferns, or in the midst of whins or other shrubs. Its senses of seeing and hearing are extremely acute; its eyes being placed directly on the sides of the head, take in a wide range, and its large ears can be readily turned in any direction forwards, outwards, or backwards, so as to catch the smallest sounds indicative of hostility. Being in a manner defenceless, and having no burrow or fastness to which it may retreat, it trusts to its vigilance and great speed to enable it to elude its numerous enemies. The excellence of its flesh makes it liable to be destroyed by persons of all degrees, and its frequent occurrence, extreme timidity, and great speed, render it a favourite object of the chase among those of equestrian rank who, for the gratification of their destructive propensities and love of excitement, are willing to indulge in a pursuit as unmanly as it is cruel.

It is chiefly to the lower and more cultivated districts that the common hare resorts; but it is also found in the upland valleys, and on the slopes of hills at a considerable height. Timid and gentle as it is, it is by no means innocuous, for the injury it occasions to the young corn is often considerable. In winter it finds an abundant supply of food in the turnip fields, and sometimes visits the gardens at night, especially when urged by hunger during continued frost. It has been observed to cross rivers by swimming, and even to enter the sea might be supposed to enjoy a state of tolerable security; but as every rapacious creature is its enemy, it but very seldom lives out its natural term. Dogs of all kinds pursue it by instinct, and follow the hare more eagerly than any other animal. The cat and the weasel kinds are continually lying in ambush, and practising all their little arts to seize it; birds of prey are still more dangerous enemies, as against them no swiftness can avail, nor retreat secure; but man, an enemy far more powerful than all, prefers its flesh to that of other animals, and destroys greater numbers than all the rest. Thus pursued and persecuted on every side, the race would long since have been totally extirpated, did it not find a resource in its amazing fertility.

The hare multiplies exceedingly; it is in a

---

for the purpose of gaining an island or point of land, on which its food was more abundant.

The female goes with young thirty days, and several times in the season produces from three to five young ones, which are born covered with hair, having their eyes open, and capable of running. The young squat in the fields, remaining motionless, like those of many of the Grallæ, and are with difficulty perceived. Even the old hares are not readily driven from their form, in which they will sometimes remain until a person is quite close to them, when they at length start off, exhibiting in their motions the haste and perturbation of extreme fear. The timidity of the hare is indeed proverbial, as is its propensity to return when wounded, or even when hunted, to its usual place of repose.* Besides being pursued with hounds, and shot for pastime, it is snared in its form or in the paths which it has made in the herbage. Its flesh is superior in flavour to that of the white hare or the rabbit; and its fur is in request for various purposes, especially the manufacture of hats. Large individuals weigh from nine to twelve pounds, but the ordinary weight is about eight.

The *Irish Hare* differs from the common in having the ears proportionally shorter, the general colour of the upper parts of a nearly uniform light brownish-red; and the tail destitute of black on its upper or anterior part. Other points of difference will be detected on comparing the descriptions of the two species. The form and proportions are in general similar to those of the common hare, but the head is somewhat shorter, as are the limbs, although I do not find that the hind legs are proportionally less elongated, as has been represented. The head is convex above, broad and rounded in front, the ears about a fourth shorter than the head; the hind feet with four, the fore feet with five toes; the claws long, slightly arched, compressed, those of the hind feet stronger. The mystachial bristles are as in the common hare, but much shorter, and not undulated. The fur is not as represented by authors, but in all essential respects similar to that of the common hare; although the long hairs are less strong and curved. They are grey at the base, then black, with a yellowish-red space towards the end, the tip black. Intermixed are scattered longer hairs, which are entirely black. The wooly hairs or under-fur are grey at the base, light red at the end. The ears are externally reddish on their inner half, greyish-white on the outer, the tip black, their inside reddish on the outer edge, the tip black. All the upper parts are light brownish-red; the throat greyish-white, the fore part of the neck dull greyish-red; the lower parts, the inside of the legs, and the greater part of the hind feet, white, the claws greyish-yellow.

Length to end of tail	24	Inches.
— of head	5	—
— of tail	3½	—
— of ears	4	—
— from heel to end of claws	5½	—

The *White Hare* is considerably smaller than the common and Irish hares, which, however, it resembles in form, although it has the ears and hind legs proportionally shorter. The number of toes, and the nature of the fur, are the same as in the other species; but the latter is softer and more woolly. In the middle of summer, the head is reddish-brown, the lips and chin brownish-white, the ears dusky on their anterior half, greyish on the posterior, with the tip black; the nape whitish; the general colour of the upper parts is dull greyish-black, intermixed with reddish. The long hairs are grey at the base, then black, with a small portion of a yellowish tint, the tip black. Some of the longer hairs are entirely black. The fine hairs or under-fur are light-grey at the base, pale reddish-brown at the end. The tail is greyish-white. The lower parts are greyish-white, as are the legs over the greater part of their extent; the toes brown; the claws dusky.

Length to end of tail	23	Inches.
— of head	4½	—
— of tail	3½	—
— of ears	3½	—
— from heel to end of claws	5½	—

In September the colours begin to assume a paler tint, many of the dusky hairs having disappeared. In October the change is farther advanced, and, towards the end of that month, the muzzle, hind neck, and feet, are white, of which there are spots and patches dispersed here and there. In December the fur seems entirely white, but has an intermixture of long blackish hairs on the back; the anterior external part of the ear is brownish, and its tip black. The under-fur is light blueish-grey at the base, pale yellowish or cream-colour towards the end. From the examination of individuals at different periods of the year, I have inferred that in this species the hair is almost always changing; that in April and May there is a general but gradual shedding, after which the summer colours are seen in perfection; that towards the middle of autumn many new white hairs have been substituted for coloured ones, and that, by degrees, all the hairs and under-fur are shed and renewed before the end of December, when the fur is in the perfection of its winter condition, being closer, fuller, and longer than in summer.

The white hare is not uncommon in the middle and northern divisions of Scotland, residing in the valleys of the Grampians and other mountainous tracts, but not ascending the hills to their summits, although in summer it keeps on the ferny slopes. It appears that this species occurs also in some of the northern parts of England. In winter, it descends to the bottom of the valleys, but never visits the lower districts. It does not burrow, but conceals itself among the ferns or heath, often in stony or rocky places. Its flesh is whiter than that of the common hare, generally leaner, and therefore less esteemed. It is said to be easily domesticated if taken young, and to exhibit less timidity and more playfulness than the common hare.

An adult male from Perthshire presented the following dimensions:

Length to end of tail	23	Inches.
Depth of body	6	—
Ears	4	—
Tibia	6	—
From heel to point of claw	5	—
Cubitus	4	—
Fore-foot	2	—

—*Naturalist's Library, vol. VII. British Quadrupeds, by William Macgillivary, Edin.* 1838.

state of engendering at a few months old; the female goes with young but thirty days, and generally brings forth three or four at a time.[1] As soon as they have produced their young, they are again ready for conception, and thus do not lose any time in continuing the breed. But they are in another respect fitted in an extraordinary manner for multiplying their kind; for the female, from the conformation of her womb, is often seen to bring forth, and yet to continue pregnant at the same time; or, in other words, to have young ones of different ages in her womb together. Other animals never receive the male when pregnant, but bring forth their young at once. But it is frequently different with the hare; the female often, though already impregnated, admitting the male, and thus receiving a second impregnation. The reason of this extraordinary circumstance is, that the womb in these animals is divided in such a manner that it may be considered as a double organ, one side of which may be filled while the other remains empty. Thus these animals may be seen to couple at every period of their pregnancy, and even while they are bringing forth young, laying the foundation of another brood.

The young of these animals are brought forth with their eyes open, and the dam suckles them for twenty days, after which they leave her, and seek out for themselves.[2] From this we observe that the education these animals receive is but trifling, and the family connection but of a short duration. In the rapacious kinds the dam leads her young forth for months together; teaches them the arts of rapine; and, although she wants milk to supply them, yet keeps them under her care until they are able to hunt for themselves. But a long connection of this kind would be very unnecessary as well as dangerous to the timid animals we are describing; their food is easily procured; and their associations, instead of protection, would only expose them to their pursuers. They seldom, however, separate far from each other, or from the place where they were produced; but make each a form at some distance, having a predilection rather for the place than each other's society. They feed during the night rather than by day, choosing the more tender blades of grass, and quenching their thirst with the dew. They live also upon roots, leaves, fruits, and corn, and prefer such plants as are furnished with a milky juice. They also strip the bark of trees during the winter, there being scarcely any that they will not feed on, except the lime or the alder. They are particularly fond off birch, pinks, and parsley. When they are kept tame, they are fed with lettuce and other garden herbs; but the flesh of such as are thus brought up is always indifferent.

They sleep or repose in their forms by day, and may be said to live only by night.[3] It is then that they go forth to feed and couple. They do not pair, however, but in the rutting season, which begins in February; the male pursues and discovers the female by the sagacity of its nose. They are then seen by moonlight, playing, skipping, and pursuing each other; but the least motion, the slightest breeze, the falling of a leaf, is sufficient to disturb their revels; they instantly fly off, and each takes a separate way.

As their limbs are made for running, they easily outstrip all other animals in the beginning; and could they preserve their speed, it would be impossible to overtake them; but as they exhaust their strength at their first efforts, and double back to the place they were started from, they are more easily taken than the fox, which is a much slower animal than they. As their hind legs are longer than the fore, they always choose to run up hill, by which the speed of their pursuers is diminished, while theirs remains the same. Their motions are also without any noise, as they have the sole of the foot furnished with hair; and they seem the only animals that have hair on the inside of their mouths.

They seldom live above seven or eight years at the utmost: they come to their full perfection in a year; and this multiplied by seven, as in other animals, gives the extent of their lives.[4] It is said, however, that the females live longer than the males; of this Mr Buffon makes a doubt; but I am assured that it is so. They pass their lives, in our climate, in solitude and silence; and they seldom are heard to cry, except when they are seized or wounded. Their voice is not so sharp as the note of some other animals, but more nearly approaching that of the squalling of a child. They are not so wild as their dispositions and their habits seem to indicate; but are of a complying nature, and easily susceptible of a kind of education. They are easily tamed. They even become fond and caressing, but they are incapable of attachment to any particular person, and never can be depended upon; for, though taken ever so young, they regain their native freedom at the first opportunity. As they have a remarkably good ear, and sit upon their hindlegs, and use their fore paws as hands, they have been taught to beat the drum, to dance to music, and go through the manual exercise.[5]

---

[1] Buffon, vol. xiii. p. 12

[2] Ibid.

[3] Buffon, vol. xiii. p. 12.

[4] Ibid.

[5] Most readers will recollect Cowper's delightful description of three hares—Puss, Tiney, and Bess—

But their natural instincts for their preservation are much more extraordinary than those artificial tricks that are taught them. They make themselves a form, particularly in those places where the colour of the grass most resembles that of their skin; it is open to the south in winter, and to the north in summer. The hare, when it hears the hounds at a distance, flies for some time through a natural impulse, without managing its strength, or

---

which he succeeded in domesticating. Although it is to be found in the usual editions of the poet's works, no one, we feel assured, will grudge its appearance here.

In the year 1774, being much indisposed both in mind and body, incapable of diverting myself either with company or books, and yet in a condition that made some diversion necessary, I was glad of any thing that would engage my attention without fatiguing it. The children of a neighbour of mine had a leveret given them for a plaything; it was at that time about three months old. Understanding better how to tease the poor creature than to feed it, and soon becoming weary of their charge, they readily consented that their father, who saw it pining and growing leaner every day, should offer it to my acceptance. I was willing enough to take the prisoner under my protection, perceiving that, in the management of such an animal, and in the attempt to tame it, I should find just that sort of employment which my case required. It was soon known among the neighbours that I was pleased with the present; and the consequence was, that in a short time I had as many leverets offered me as would have stocked a paddock. I undertook the care of three, which it is necessary I should here distinguish by the names I gave them—Puss, Tiney, and Bess. Notwithstanding the two feminine appellatives, I must inform you that they were all males. Immediately commencing carpenter, I built them houses to sleep in; each had a separate apartment, so contrived, that their ordure would pass through the bottom of it; an earthen pan placed under each received whatsoever fell, which being duly emptied and washed, they were thus kept perfectly sweet and clean. In the day-time, they had the range of a hall, and at night retired each to his own bed, never intruding into that of another.

Puss grew presently familiar, would leap into my lap, raise himself upon his hinder feet, and bite the hair from my temples. He would suffer me to take him up, and to carry him about in my arms, and has more than once fallen fast asleep upon my knee. He was ill three days, during which time I nursed him, kept him apart from his fellows, that they might not molest him, (for, like many wild animals, they persecute one of their own species that is sick,) and by constant care and trying him with a variety of herbs, restored him to perfect health. No creature could be more grateful than my patient after his recovery; a sentiment which he most significantly expressed by licking my hand, first the back of it, then the palm, then every finger separately, then between all the fingers, as if anxious to leave no part of it unsaluted; a ceremony which he never performed but once again upon a similar occasion. Finding him extremely tractable, I made it my custom to carry him always after breakfast into the garden, where he hid himself generally under the leaves of a cucumber vine, sleeping or chewing the cud till evening; in the leaves also of that vine he found a favourite repast. I had not long habituated him to this taste of liberty, before he began to be impatient for the return of the time when he might enjoy it. He would invite me to the garden by drumming upon my knee, and by a look of such expression, as it was not possible to misinterpret. If this rhetoric did not immediately succeed, he would take the skirt of my coat between his teeth and pull at it with all his force. Thus Puss might be said to be perfectly tamed, the shyness of his nature was done away, and on the whole it was visible by many symptoms, which I have not room to enumerate, that he was happier in human society, than when shut up with his natural companions.

Not so Tiney: upon him the kindest treatment had not the least effect. He too was sick, and in his sickness had an equal share of my attention; but if, after his recovery, I took the liberty to stroke him, he would grunt, strike with his fore feet, spring forward, and bite. He was, however, very entertaining in his way; even his surliness was matter of mirth, and in his play he preserved such an air of gravity, and performed his feats with such a solemnity of manner, that in him too I had an agreeable companion.

Bess, who died soon after he was full grown, and whose death was occasioned by his being turned into his box, which had been washed, while it was yet damp, was a hare of great humour and drollery. Puss was tamed by gentle usage; Tiney was not to be tamed at all; and Bess had a courage and confidence that made him tame from the beginning. I always admitted them into the parlour after supper, when, the carpet affording their feet a firm hold, they would frisk, and bound, and play a thousand gambols, in which Bess, being remarkably strong and fearless, was always superior to the rest, and proved himself the Vestris of the party. One evening the cat being in the room, had the hardiness to pat Bess upon the cheek, an indignity which he resented, by drumming upon her back with such violence, that the cat was happy to escape from under his paws and hide herself.

I describe these animals as having each a character of his own. Such they were in fact, and their countenances were so expressive of that character, that when I looked only on the face of either, I immediately knew which it was. It is said that a shepherd, however numerous his flock, soon becomes so familiar with their features, that he can by that indication only, distinguish each from all the rest; and yet, to a common observer, the difference is hardly perceptible. I doubt not that the same discrimination in the cast of countenances would be discoverable in hares, and am persuaded that among a thousand of them, no two could be found exactly similar: a circumstance little suspected by those who have not had opportunity to observe it. These creaturer have a singular sagacity in discovering the minutest alteration that is made in the place to which they are accustomed, and instantly apply their nose to the examination of a new object. A small hole being burned in the carpet, it was mended with a patch, and that patch in a moment underwent the strictest scrutiny. They seem too to be very much directed by the smell in the choice of their favourites: to some persons, though they saw them daily, they could never be reconciled, and would even scream when they attempted to touch them; but a miller coming in, engaged their affections at once; his powdered coat had charms that were irresistible. It is no wonder that my intimate acquaintance with these specimens of the kind has taught me to hold the sportsman's amusement in abhorrence; he little knows what amiable creatures he persecutes, of what gratitude they are capable, how cheerful they are in their spirits, what enjoyment they have of life, and that, impressed as they seem with a peculiar dread of man, it is only because man gives them peculiar cause for it.

That I may not be tedious, I will just give a short summary of those articles of diet that suit them best.

I take it to be a general opinion that they graze, but it is an erroneous one, at least grass is not their staple;

consulting any other means but speed for its safety. Having attained some hill or rising ground, and left the dogs so far behind that it no longer hears their cries, it stops, rears on its hinder legs, and at length looks back to see if it has not lost its pursuers. But these, having once fallen upon the scent, pursue slowly and with united skill, and the poor animal soon again hears the fatal tidings of their approach. Sometimes when sore hunted it will start a fresh hare, and squat in the same form; sometimes it will creep under the door of a sheep-cot, and hide among the sheep; sometimes it will run among them, and no vigilance can drive it from the flock; some will enter holes like the rabbit, which the hunters call going to *vault;* some will go up one side of the hedge and come down the other; and it has been known that a hare sorely hunted has got upon the top of a quickset hedge, and run a good way thereon, by which it has effectually evaded the hounds. It is no unusual thing also for them to betake themselves to furze bushes, and to leap from one to another, by which the dogs are frequently misled. However, the first doubling a hare makes is generally a key to all its future attempts of that kind, the latter being exactly like the former. The young hares tread heavier and leave a stronger scent than the old, because their limbs are weaker; and the more this forlorn creature tires, the heavier it treads, and the stronger is the scent it leaves. A buck, or male hare, is known by its choosing to run upon hard highways, feeding farther from the wood-sides, and making its doubling of a greater compass than the female. The male having made a turn or two about its form, frequently leads the hounds five or six miles on a stretch; but the female keeps close by some covert side, turns, crosses, and winds among the bushes like a rabbit, and seldom runs directly forward. In general, however, both male and female regulate their conduct according to the weather. In a moist day they hold by the highways more than at any other time, because the scent is then strongest upon the grass. If they come to the side of a grove or spring, they forbear to enter, but squat down by the side thereof until the hounds have overshot them; and then, turning along their former path, make to their old form, from which they vainly hope for protection.[1]

---

they seem rather to use it medicinally, soon quitting it for leaves of almost any kind. Sow-thistle, dandelion, and lettuce are their favourite vegetables, especially the last. I discovered by accident, that fine white sand is in great estimation with them; I suppose as a digestive. It happened that I was cleaning a bird-cage while the hares were with me: I placed a pot filled with such sand upon the floor, which being at once directed to by a strong instinct, they devoured voraciously; since that time I have generally taken care to see them well supplied with it. They account green corn a delicacy, both blade and stalk, but the ear they seldom eat; straw of any kind, especially wheat straw, is another of their dainties; they will feed greedily upon oats, but if furnished with clean straw never want them; it serves them also for a bed, and if shaken up daily, will be kept sweet and dry for a considerable time. They do not indeed require aromatic herbs, but will eat a small quantity of them with great relish, and are particularly fond of the plant called musk; they seem to resemble sheep in this, that if their pasture be too succulent, they are very subject to the rot: to prevent which, I always made bread their principal nourishment, and filling a pan with it cut into small squares, placed it every evening in their chambers, for they feed only at evening and in the night: during the winter when vegetables were not to be got, I mingled this mess of bread with shreds of carrot, adding to it the rind of apples, cut extremely thin; for though they are fond of the paring, the apple itself disgusts them. These however not being a sufficient substitute for the juice of summer herbs, they must at this time be supplied with water; but so placed that they cannot overset it into their beds. I must not omit, that occasionally they are much pleased with twigs of hawthorn, and of the common brier, eating even the very wood when it is of considerable thickness.

Bess, I have said, died young; Tiney lived to be nine years old, and died at last, I have reason to think, of some hurt in his loins by a fall; Puss is still living, and has completed his tenth year, discovering no signs of decay, nor even of age, except that he is grown more discreet and less frolicsome than he was. I cannot conclude without observing that I have lately introduced a dog to his acquaintance, a spaniel that had never seen a hare, to a hare that had never seen a spaniel. I *did* it with great caution, but there was no real need of it. Puss discovered no token of fear, nor Marquis the least symptom of hostility. There is therefore, it should seem, no natural antipathy between dog and hare, but the pursuit of the one occasions the flight of the other, and the dog pursues because he is trained to it; they eat bread at the same time out of the same hand, and are in all respects sociable and friendly.

I should not do complete justice to my subject, did I not add that they have no ill scent belonging to them, that they are indefatigably nice in keeping themselves clean, for which purpose nature has furnished them with a brush under each foot; and that they are never infested by any vermin.

May 28, 1784.

Memorandum found among Mr Cowper's papers.

Tuesday, March 9, 1786.

This day died poor Puss, aged eleven years, eleven months. He died between twelve and one at noon, of mere old age, and apparently without pain.

[1] The difficulty of finding a hare by the eye is well known. It is an art greatly facilitated by experience, although not one person in ten who attempts it succeeds in it. But here we recognise the hand that furnished her with such means for her security; as, from the delicacy of her flesh, she is the prey of every carnivorous animal, and her means of defence are confined only to her flight. In going to her form, she consults the weather, especially the wind, lying always, when she can, with her head to face it. After harvest, hares are found in all situations; in stubble fields, hedge-rows, woods, and brakes; but when the leaves fall, they pre-

Hares are divided, by the hunters, into mountain and measled hares. The former are more swift, vigorous, and have the flesh better tasted; the latter chiefly frequent the marches, when hunted keep among low grounds, and their flesh is moist, white, and flabby. When the male and female keep one particular spot, they will not suffer any strange hare to make its form in the same quarter; so that it is usually said, that the more you hunt, the more hares you shall have; for, having killed one hare, others come and take possession of its form. Many of these animals are found to live in woods and thickets, but they are naturally fond of the open country, and are constrained only by fear to take shelter in places that afford them neither a warm sun nor an agreeable pasture. They are therefore usually seen stealing out of the hedges of the wood to taste the grass that grows shorter and sweeter in the open fields than under the shade of the trees; however, they seldom miss of being pursued; and every excursion is a new adventure. They are shot at by poachers; traced by their footsteps in the snow; caught in springs; dogs, birds, and cats, are all combined against them; ants, snakes, and adders, drive them from their forms, especially in summer; even fleas, from which most other animals are free, persecute this poor creature; and so various are its enemies, that it is seldom permitted to reach even that short term to which it is limited by nature.

The soil and climate have their influence upon this animal, as well as on most others. In the countries bordering on the north pole, they become white in winter, and are often seen in great troops of four or five hundred, running along the banks of the Irtish, or the Jenisca, and are as white as the snow they tread on. They are caught in traps for the sake of their skins, which, on the spot, are sold for less than seven shillings a hundred. Their fur is well known to form a considerable article in the hat manufacture; and we accordingly import vast quantities of it from those countries where the hare abounds in such plenty. They are found also entirely black, but these in much less quantities than the former;[1] and even some have been seen with horns, though these but rarely.[2]

The hares in the hot countries, particularly in Italy, Spain, and Barbary, are smaller than ours: those bred in the Milanese country are said to be the best in Europe.[3] There is scarcely a country where this animal is not to be found, from the torrid zone to the neighbourhood of the polar circle.[4] The natives of Guinea knock them on the head as they come down to the sides of the rivers to drink. They also surround the place where they are seen in numbers, and clattering a short stick, which every man carries, against that which the person next him carries, they diminish their circle gradually, till the hares are cooped up in the midst. They then altogether throw their sticks in among them, and with such deadly force, that they seldom fail of killing great numbers at a time.[5]

The flesh of this animal has been esteemed a delicacy among some nations, and it is held in detestation by others. The Jews, the ancient Britons, and the Mahometans, all considered it as an unclean animal, and religiously abstained from it. On the contrary, there are scarce any other people, however barbarous at present, that do not consider it as the most agreeable food. Fashion seems to preside and

---

fer lying upon open ground, and particularly on a stale fallow, that is, one which has been some time ploughed; as likewise after frost, and towards the spring of the year. In furze, or gorse, they lie so close as to allow themselves nearly to be trodden upon, rather than quit their form The down or upland-bred hare shows best sport; that bred in a wet marshy district, the worst, although the scent from the latter may be the stronger. If a hare, when not viewed away, runs slowly at first, it is generally a sign that she is an old one, and likely to afford sport; but hares never run so well as when they do not know where they are. Thus, trapped hares, turned out before hounds, almost invariably run straight on end, and generally till they can run no longer; and they generally go straight in a fog. The chase of the hare has been altered, and rendered less difficult in some degree, by the improvement of the hound used in it.

The difference in the terms used in hare-hunting and fox-hunting is comprised in a few words:—Harriers are cast off, in the morning; fox-hounds thrown off. The hare is found by the quest or trail; the fox by the drag. The hare is on her form or seat; the fox in his kennel. The young hare is a leveret; a fox a year old is a cub. The view holloa of the hare is, "Gone away;" of a fox, "Tallyho." The hare doubles in chase; the fox heads back, or is headed. The harrier is at fault; the fox-hound at check. The hare is pricked by the foot; the fox is balled or padded. The hare squats; the fox lies down, stops, or hangs in cover; the "who-whoop" signifies the death of each.

[1] Klein. Disp. Quadrup. p. 52. [2] Johnston de Quadrup. l. ii. c. 2. [3] Dictionnaire Raisonnée, Lievre.

[4] The Tapeti or Brazilian hare is the smallest of the known species. From the tip of the nose to the insertion of the tail, it measures about eighteen inches, and the tail itself with the hair upon it, which makes it round, does not exceed ten lines. The fur is varied, brown, black, and yellowish above, with the upper part of the head red brown, without any sprinkling of yellow; the cheeks are greyish; a lightish line passes round the eyes; the lower edge of the nose, the lips, and the under part of the head; the chest, and belly and insides of the legs, are white. The Tapeti does not burrow in the earth, but lives in woods and sits on the surface like the common hare; when hunted, he endeavours to hide himself under the trunks of trees; or in the high grass. The flesh tastes like that of the rabbit. The female is said to bring forth but one litter of three or four in the year. The *Viscache* of Brazil and Chili, though usually classed among the hares, seems to belong to a subgenus, analogous to the chinchilla.

[5] Hist. Gen. des Voyages, tom. iv. p. 171.

govern all the senses; what mankind at one time consider as beautiful, fragrant, or savoury, may at another time, or among other nations, be regarded as deformed, disgustful, or ill-tasted. That flesh which the ancient Romans so much admired, as to call it the food of the wise, was, among the Jews and the Druids, thought unfit to be eaten; and even the moderns, who, like the Romans, consider the flesh of this animal as a delicacy, have very different ideas as to dressing it. With us it is simply served up without much seasoning; but Apicius shows us the manner of dressing a hare in true Roman taste, with parsley, rice, vinegar, cummin seed, and coriander.[1]

THE RABBIT.[2]

(*See Plate XIII. fig.* 15.)

The hare and the rabbit, though so very nearly resembling each other in form and disposition, are yet distinct kinds, as they refuse to mix with each other. Mr Buffon bred up several of both kinds in the same place; but from being at first indifferent, they soon became enemies; and their combats were generally continued until one of them was disabled or destroyed. However, though these experiments were not attended with success, I am assured that nothing is more frequent than an animal bred between these two, but which, like the mule, is marked with sterility. Nay, it has been actually known that the rabbit couples with animals of a much more distant nature; and there is at present in the Museum at Brussels, a creature covered with feathers and hair, and said to be bred between a rabbit and a hen. The fecundity of the rabbit is still greater than that of the hare; and if we should calculate the produce from a single pair in one year, the number would be amazing. They breed seven times in a year, and bring eight young ones each time. On a supposition, therefore, that this happens regularly, at the end of four years a couple of rabbits shall see a progeny of almost a million and a half. From hence we must justly apprehend being overstocked by their increase; but, happily for mankind, their enemies are numerous, and their nature inoffensive; so that their destruction bears a near proportion to their fertility.

But although their numbers be diminished by every beast and bird of prey, and still more by man himself, yet there is no danger of their extirpation. The hare is a poor defenceless animal, that has nothing but its swiftness to depend on for safety; its numbers are, therefore, every day decreasing; and in countries that are well peopled, the species are so much kept under, that laws are made for their preservation. Still, however, it is most likely that they will be at last totally destroyed; and, like the wolf or the elk in some countries, be only kept in remembrance. But it is otherwise with the rabbit, its fecundity being greater, and its means of safety more certain. The hare seems to have more various arts and instincts to escape its pursuers, by doubling, squatting, and winding; the rabbit has but one art of defence alone, but in that one finds safety, by making itself a hole, where it continues a great part of the day, and breeds up its young; there it continues secure from the fox, the hound, the kite, and every other enemy.

Nevertheless, though this retreat be safe and convenient, the rabbit does not seem to be naturally fond of keeping there. It loves the sunny field and the open pasture; it seems to be a chilly animal, and dislikes the coldness of its under-ground habitation. It is, therefore, continually out, when it does not fear disturbance; and the female often brings forth her young at a distance from the warren, in a hole, not above a foot deep at the most. There she suckles them for about a month, covering them over with moss and grass, whenever she goes to pasture, and scratching them up at her return.[3] It has been said, indeed, that this shallow hole without the warren is made lest the male should attack and destroy her young; but I have seen the male himself attend the young there, lead them out to feed, and conduct them back upon the return of the dam. This external retreat seems a kind of country house, at a distance from the general habitation; it is usually made near some spot of excellent pasture, or in the midst of a field of sprouting corn. To this both male and female often retire from the warren, lead their young by night to the food which lies so convenient, and, if not disturbed, continue there till they are grown up. There they find a greater variety of pasture than near the warren, which is generally eaten bare; and enjoy a warmer sun, by covering themselves up in a shallower hole. Whenever they are disturbed, they then forsake their retreat of pleasure for one of safety; they fly to the warren with their utmost speed; and if the way be short, there is scarcely any dog, how swift soever, that can overtake them.

---

[1] Vid. Apicii, &c.

[2] The rabbit is said to be originally from Spain, but it has been for ages common in the rest of Europe, and is now transported into Africa and America. Domestication has produced various varieties in these animals, black, silvery white, and some with long silky hairs, called Angora rabbits.

We are assured on the authority of those who have paid great attention to the subject, that rabbits live in a social state, and take an interest in each other, and even have something like respect for the right of property. In their republic, as in that of Lacedæmon, old age, parental affection, and hereditary rights are respected; the same burrow is said to pass from father to son, and lineally from generation to generation; it is never abandoned by the same family without necessity, but is enlarged as the number of the family increases by the addition of more galleries or apartments. This succession of patrimony, this right of property among these animals, has been long observed, nor have the modern investigations in zoology disproved its existence.—*Griffith.*

[3] The care with which a doe rabbit provides for her young is very remarkable. She not only makes a nest of the softest hay, from which she carefully munches out all the harder portions, but she actually strips the fur or down off her own breast to spread over the hay. At first she covers up her young ones with the same materials in order to keep them warm, uncovering them only for the purpose of giving them suck. She is also extremely careful in proportioning this covering to the severity of the weather and the tenderness or strength of her offspring, gradually diminishing it as they grow more robust.

But it does not always happen that these animals are possessed of one of these external apartments; they most usually bring forth their young in the warren, but always in a hole, separate from the male. On these occasions, the female digs herself a hole,[1] different from the ordinary one, by being more intricate; at the bottom of which she makes a more ample apartment. This done, she pulls off from her belly a good quantity of her hair, with which she makes a kind of bed for her young. During the two first days she never leaves them; and does not stir out but to procure nourishment, which she takes with the utmost despatch; in this manner suckling her young for near six weeks until they are strong, and able to go abroad themselves. During all this time, the male seldom visits their separate apartments; but when they are grown up, so as to come to the mouth of the hole, he then seems to acknowledge them as his offspring, takes them between his paws, smooths their skins, and licks their eyes; all of them, one after the other, have an equal share in his caresses.

In this manner the rabbit, when wild, consults its pleasure and its safety; but those that are bred up tame, do not take the trouble of digging a hole, conscious of being already protected. It has also been observed,[2] that when people, to make a warren, stock it with tame rabbits, these animals, having been unaccustomed to the art of scraping a hole, continue exposed to the weather, and every other accident, without ever burrowing. Their immediate offspring also are equally regardless of their safety: and it is not till after two or three generations that these animals begin to find the necessity and convenience of an asylum, and practise an art which they could only learn from nature.

Rabbits of the domestic breed, like all other animals that are under the protection of man, are of various colours; white, brown, black, and mouse-colour. The black are the most scarce; the brown, white, and mouse-colour, are in greater plenty. Most of the wild rabbits are of a brown, and it is the colour which prevails among the species; for in every nest of rabbits, whether the parents be black or white, there are some brown ones found of the number. But, in England, there are many warrens stocked with the mouse-colour kinds, which some say came originally from an island in the river Humber, and, which still continue their original colour, after a great number of successive generations. A gentleman,[3] who bred up tame rabbits for his amusement, gives the following account of their production: "I began" says he, "by having but one male and female only; the male was entirely white, and the female brown; but, in their posterity, the number of the brown by far exceeded those of any other colour: there were some white, some particoloured, and some black. It is surprising how much the descendants were obedient and submissive to their common parent; he was easily distinguished from the rest by his superior whiteness; and, however numerous the other males were, this kept them all in subjection. Whenever they quarrelled among each other, either for their females or provisions, as soon as he heard the noise, he ran up to them with all despatch, and, upon his appearance, all was instantly reduced to peace and order. If he caught any of them in the fact, he instantly punished them, as an example to the rest. Another instance of his superiority was, that having accustomed them to come to me with the call of a whistle, the instant this signal was given I saw him marshalling them up, leading them the foremost, and then suffering them all to file off before him."

The rabbit,[4] though less than the hare, generally lives longer. As these animals pass the greater part of their lives in their burrow, where they continue at ease and unmolested, they have nothing to prevent the regularity of their health, or the due course of their nourishment. They are, therefore, generally found fatter than the hare; but their flesh is, notwithstanding, much less delicate. That of the old ones, in particular, is hard, tough, and dry; but it is said, that in warmer countries they are better tasted. This may very well be, as the rabbit, though so very plentiful in Great Britain and Ireland, is nevertheless a native of the warmer climates; and has been originally imported into these kingdoms from Spain. In that country, and in some of the islands in the Mediterranean, we are told that they once multiplied in such numbers as to prove the greatest nuisance to the natives. They at first demanded military aid to destroy them; but soon after they called in the assistance of ferrets, which originally came from Africa, and these, with much more ease and expedition, contrived to lessen the calamity. In fact, rabbits are found to love a warm climate, and to be incapable of bearing the cold of the north; so that in Sweden they are obliged to be littered in the houses. It is otherwise in all the tropical climates, where they are extremely common, and where they seldom burrow, as with us. The English counties that are most noted for these animals, are Lincolnshire, Norfolk, and Cambridgeshire. They delight in grounds of a sandy soil, which are warmer than those of clay; and which also furnish a softer and finer pasture.

---

[1] Buffon.

[2] Ibid.

[3] Mr Moutier, as quoted by Mr Buffon. Ibid.

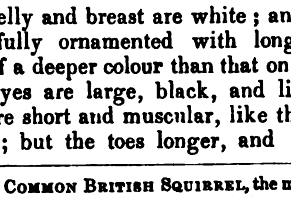
The tame rabbits are larger than the wild ones from their taking more nourishment, and using less exercise; but their flesh is not so good, being more insipid and softer. In order to improve it, they are chiefly fed upon bran, and are stinted in their water; for if indulged in too great plenty of moist food, they are apt, as the feeders express it, to grow rotten. The hair or fur is a very useful commodity, and is employed in England for several purposes, as well when the skin is dressed with it on, as when it is pulled off. The skins, especially the white, are used for lining clothes, and are considered as a cheap imitation of ermine. The skin of the male is usually preferred, as being the most lasting, but it is coarser; that on the belly, in either sex, is the best and finest. But the chief use made of rabbit's fur is in the manufacture of hats; it is always mixed, in certain proportions, with the fur of the beaver; and it is said to give the latter more strength and consistence.

The Syrian rabbit, like all other animals bred in that country, is remarkable for the length of its hair; it falls along the sides in wavy wreaths, and is in some places curled at the end, like wool; it is shed once a year in large masses; and it often happens that the rabbit, dragging a part of its robe on the ground, appears as if it had got another leg, or a longer tail. There are no rabbits naturally in America; however those that have been carried from Europe, are found to multiply in the West India islands in great abundance. In other parts of that continent, they have animals that in some measure resemble the rabbits of Europe; and which most European travellers have often called *hares* or *rabbits*, as they happened to be large or small. Their giving them even the name will be a sufficient excuse for my placing them among animals of the hare kind; although they may differ in many of the most essential particulars. But before we go to the new continent, we will first examine such as bear even a distant resemblance to the hare kind at home.

THE SQUIRREL.[1]

There are few readers that are not so well acquainted with the figure of a Squirrel as that of the rabbit; but supposing it unknown to any, we might give them some idea of its form, by comparing it to a rabbit, with shorter ears, and a longer tail. The tail indeed, is alone sufficient to distinguish it from all others, as it is extremely long, beautiful and bushy, spreading like a fan, and which, when thrown up behind, covers the whole body. This serves the little animal for a double purpose; when erected, it serves, like an umbrella, as a secure protection from the injuries of the heat and cold; and when extended, it is very instrumental in promoting those vast leaps that the squirrel takes from tree to tree; nay, some assert that it answers still a third purpose, and when the squirrel takes the water, which it sometimes does upon a piece of bark, that its tail serves it instead of a sail.[2]

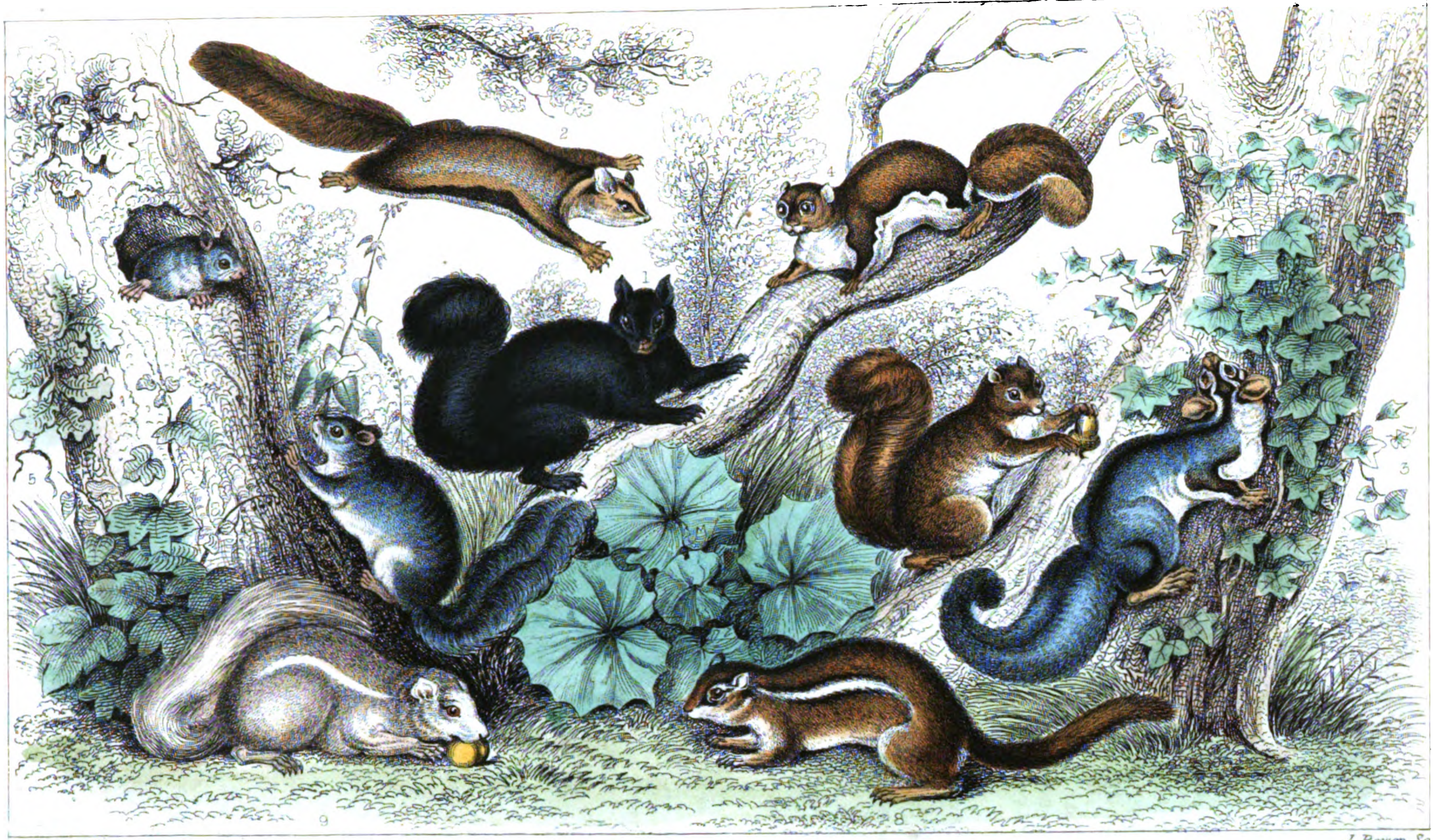
There are few wild animals in which there are so many varieties as in the squirrel. The *common squirrel* is of the size of a small rabbit, and is rather of a more reddish brown. The belly and breast are white; and the ears beautifully ornamented with long tufts of hair, of a deeper colour than that on the body The eyes are large, black, and lively; the legs are short and muscular, like those of the rabbit; but the toes longer, and the claws



---

[1] The COMMON BRITISH SQUIRREL, the most interesting and amusing of our wild animals, is figured in coloured Plate XLI., fig. 7. The characteristics of the squirrel tribe are, incisors $\frac{2}{2}$, and grinders $\frac{4}{4}$, $\frac{5}{4}$. For representations of the Chichasee squirrel, see Plate XII., fig. 46; of the lesser American flying squirrel, Plate XIV., fig. 10; and coloured Plate XLI., fig. 4.

[2] Klein. Linnæus.



J. Stewart Del. J. Bower Sc.

1.AMERICAN BLACK SQUIRREL. 2.ARIEL PETAURUS. 3.SQUIRREL-LIKE PETAURUS. 4.LESSER AMERICAN FLYING SQUIRREL.

5.6. GREY SQUIRREL. 7. COMMON BRITISH SQUIRREL. 8.COMMON GROUND SQUIRREL. 9. AGIUMP SQUIRREL.

Blackie & Son. Glasgow, Edinburgh & London

sharper, so as to fit it for climbing. When it eats, or dresses itself, it sits erect, like the hare or rabbit, making use of its fore-legs as hands; and chiefly resides in trees. The *gray Virginian squirrel*, which Mr Buffon calls the *petit gris*, is larger than a rabbit, and of a grayish colour. Its body and limbs are thicker than those of the common squirrel; and its ears are shorter, and without tufts at the point. The upper part of the body, and external part of the legs, are of a fine whitish gray, with a beautiful red streak on each side lengthways. The tail is covered with very long gray hair, variegated with black and white towards the extremity. This variety seems to be common to both continents; and in Sweden is seen to change colour in winter. The *Barbary squirrel*, of which Mr Buffon makes three varieties, is of a mixed colour, between red and black. Along the sides there are white and brown lines, which render this animal very beautiful; but what still adds to its elegance is that the belly is of a sky blue, surrounded with white. Some of these hold up their tail erect; and others throw it forward over their body. The *Siberian white squirrel* is of the size of a common squirrel. The *Carolina black squirrel* is much bigger than the former, and sometimes tipped with white at all the extremities. The *Brasilian squirrel*, which Mr Buffon calls the *coquallin*, is a beautiful animal of this kind, and very remarkable for the variety of its colours. Its belly is of a bright yellow; its head and body variegated with white, black, brown, and orange colour. It wants the tufts at the extremity of its ears; and does not climb trees, as most of the kind are seen to do. To this list may be added the *little ground squirrel of Carolina*, of a reddish colour, and blackish stripes on each side; and, like the former, not delighting in trees.[1] Lastly, the *squirrel of New Spain*, which is of a deep iron-grey colour, with seven longitudinal whitish streaks along the sides of the male, and five along those of the female. As for the flying squirrels, they are a distinct kind, and shall be treated of by themselves.

These, which I suppose to be but a few of the numerous varieties of the squirrel, sufficiently serve to show how extensive this animal is diffused over all parts of the world. It is not to be supposed, however, that every variety is capable of sustaining every climate; for few animals are so tender, or so little able to endure a change of abode, as this. Those bred in the tropical climates, will only live near a warm sun; while, on the contrary, the squirrel of Siberia will scarce endure the temperature of ours. These varieties do not only differ, in their constitutions and colour, but in their dispositions also; for while some live on the tops of trees, others feed, like rabbits, on vegetables below. Whether any of these, so variously coloured, and so differently disposed, would breed among each other, we cannot tell: and since, therefore, we are left in uncertainty upon this point, we are at liberty either to consider each as a distinct species by itself; or only a variety, that accident might have originally produced, and that the climate or soil might have continued. For my own part, as the original character of the squirrel is so strongly marked upon them all, I cannot help considering them in the latter point of view; rather as the common descendants of one parent, than originally formed with such distinct similitudes.

The squirrel is a beautiful little animal, which is but half savage; and which, from the gentleness and innocence of its manners, deserves our protection. It is neither carnivorous nor hurtful: its usual food is fruits, nuts, and acorns; it is cleanly, nimble, active, and industrious; its eyes are sparkling, and its physiognomy marked with meaning. It generally, like the hare and rabbit, sits upon its hinder legs, and uses the fore-paws as hands; these have five *claws* or *toes*, as they are called, and one of them is separated from the rest like a thumb. This animal seems to approach the nature of birds, from its lightness, and surprising agility on the tops of trees. It seldom descends to the ground, except in case of storms, but jumps from one branch to another; feeds, in spring, on the buds and young shoots; in summer, on the ripening fruits, and particularly the young cones of the pine tree. In autumn it has an extensive variety to feast upon; the acorn, the filbert, the chestnut, and the wilding. This season of plenty, however, is not spent in idle enjoyment; the provident little animal gathers at that time its provisions for the winter; and cautiously foresees the season when the forest shall be stripped of its leaves and fruitage.

---

[1] The ground squirrels, as they are popularly designated (coloured Plate XLI., fig. 8) are almost exclusively limited to the northern and temperate regions of both continents. The palm squirrel of India and the Barbary squirrel may seem exceptions, but these, though they have been associated with them by some authors, do not belong to them, but occupy an intermediate station between the ground and the arboreal squirrels. The species which the genus *Tamias* includes do not exceed five or six, as known at present. The head is narrower and more pointed than in the genus *Sciurus*, of which the common squirrel is the type; the fur is shorter, the tail less bushy, and the lateral arrangement of the hairs of this part decidedly less marked. They have cheek-pouches, which the true squirrels have not, and seldom climb trees, unless when obliged in order to escape a pressing danger. Though dwelling in countries where the winter cold is often intense and always severe, they do not hybernate, as is the case with the marmout of the Alps, or the dormouse, but are lively, and stirring abroad when the earth is bound up with frost, unless indeed in the most northern regions, when they sojourn in their burrows while the snow is upon the ground. In these burrows they accumulate a large store of winter-provision, which consists of nuts, seeds, herbs, and grasses. Of one species, the four-banded ground squirrel, (*Tamias quadrivittatus*,) which is a native of North America, being found as far north as the Great Slave Lake and along the range of the Rocky Mountains, Dr Richardson observes that, "it is an exceedingly active little animal, and very industrious in storing up provisions, being generally observed with its pouches full of the seeds of leguminous plants, bents, and grasses. It is most common in dry, sandy spots, where there is much underwood, and is often seen, in the summer time, sporting among the branches of willows and low bushes. It is a lively, restless animal, troublesome to the hunter, and often provokes him to destroy it by the angry, chirrupping noise it makes on his approach, and which is a signal of alarm to the other inhabitants of the forest. During the winter it resides in a burrow, with several openings, made at the root of a tree, and is never seen on the surface of the snow at that season. When the snow disappears, many small collections of hazel-nut shells, from which the kernel has been extracted by a minute hole gnawed in the side, are to be seen on the

Its nest is generally formed among the large branches of a great tree, where they begin to fork off into small ones. After choosing the place where the timber begins to decay, and a hollow may the more easily be formed, the squirrel begins by making a kind of level between the forks; and then bringing moss, twigs, and dry leaves, it binds them together with great art, so as to resist the most violent storm. This is covered up on all sides; and has but a single opening at top, which is just large enough to admit the little animal; and this opening is itself defended from the weather by a kind of canopy, made in the fashion of a cone, so that it throws off the rain, though ever so heavy. The nest thus formed, with a very little opening above, is, nevertheless, very commodious and roomy below; soft, well knit together, and every way convenient and warm. In this retreat the little animal brings forth its young, shelters itself from the scorching heat of the sun, which it seems to fear, and from the storms and inclemency of winter, which it is still less capable of supporting. Its provision of nuts and acorns is seldom in its nest, but in the hollows of the tree, laid up carefully together, and never touched but in cases of necessity.[1] Thus one single tree serves for a retreat and a storehouse; and without leaving it during the winter, the squirrel possesses all those enjoyments that its nature is capable of receiving. But it sometimes happens that its little mansion is attacked by a deadly and powerful foe. The martin goes often in quest of a retreat for its young, which it is incapable of making for itself; for this reason it fixes upon the nest of a squirrel, and, with double injustice, destroys the tenant, and then takes possession of the mansion.

However, this is a calamity that but seldom happens: and of all other animals, the squirrel leads the most frolicsome playful life, being surrounded with abundance, and having few enemies to fear. They are in heat early in spring; when, as a modern naturalist says,[2] it is very diverting to see the female feigning an escape from the pursuit of two or three males, and to observe the various proofs which they give of their agility, which is then exerted in full force. Nature seems to have been particular in her formation of these animals for propagation: however, they seldom bring forth above four or five young at a time; and that but once a year. The time of their ges-

---

ground near its holes. Mr Say states its nest to be composed of an extraordinary quantity of the burrs of *xanthium*, portions of the upright *cactus*, small branches of pine-trees, and other vegetable productions, sufficient in some instances to fill a cart. On the banks of the Saskatchewan the mouths of their burrows are not so protected."

In size the ground squirrel is inferior to a rat, the length of the head and body being about six inches, that of the tail three. Its form is slender;—the eyes are large, the ears rounded and erect;—the cheek-pouches of moderate size, extend a short way behind the ear, and open into the mouth between the incisors and the grinders. The general colour of the back is yellowish brown, passing into red on the lower part of the back and spreading over the limbs. Along each side runs a distinct white streak, bordered above and below by a similar line of blackish brown, and a line of this colour extends from the occiput down the spine. The fur of the under surface of the body is white.

The genus *Tamias* must be regarded as an intervening link between the squirrels and the marmots, leading to the former through the Barbary and palm squirrel, and through the genus *Spermophilus* to the latter. To this group of the marmots indeed it has a very close affinity.

[1] SQUIRREL-LIKE PETAURUS (*Petaurus Sciurus*), is an inhabitant of New South Wales, and is called by the colonists the Sugar Squirrel. It is also known by the name of the Norfolk Island Flying Squirrel. Length eight inches and a half, exclusive of the tail, which measures about the length of the body. Coloured Plate XLI., figs. 2 and 3.

THE GREY SQUIRREL (*Sciurus cinereus*), is also named the Carolina Squirrel, from the country in which it is found. It is exceedingly lively and rapid in its motions; is easily accustomed to captivity, and is fond of basking in warm situations. Towards evening it collects hay and straw in its cage, and forms a ball, into which it retires until the morning It is rather larger than the common species, and seems to have no fixed character as to colour. Coloured Plate XLI., figs. 5 and 6.

THE AMERICAN BLACK SQUIRREL (*Sciurus niger*) and the AGIUMP SQUIRREL (*Sciurus setosus*) are represented in coloured Plate XLI., figs. 1 and 9. The one is remarkable for its black colour, sometimes relieved with white at the extremities, and the other for the silkiness of the tail.

The industry of the Squirrel in providing for its winter sustenance has led, to a considerable extent, to the spontaneous growth of the oak. The little creature buries acorn after acorn, but appears either to be negligent or forgetful of some of its treasures, which are thus left to germinate and spring up into oaks.

[2] British Zoology.

tation seems to be about six weeks; they are pregnant in the beginning of April, and bring forth about the middle of May.

The squirrel is never found in the open fields, nor yet in copses or underwoods: it always keeps in the midst of the tallest trees, and, as much as possible, shuns the habitations of men. It is extremely watchful; if the tree in which it resides be but touched at the bottom, the squirrel instantly takes the alarm, quits its nest, at once flies off to another tree, and thus travels, with great ease, along the tops of the forest, until it finds itself perfectly out of danger. In this manner it continues for some hours at a distance from home, until the alarm be past away; and then returns, by paths that to all quadrupeds but itself are utterly impassable. Its usual way of moving is by bounds; these it takes from one tree to another, at forty feet distance; and if at any time it is obliged to descend, it runs up the side of the next tree with amazing facility. It has an extremely sharp piercing note, which most usually expresses pain; it has another more like the purring of a cat, which it employs when pleased; at least it appeared so in that from whence I have taken a part of this description.

In Lapland, and the extensive forests to the north, the squirrels are observed to change their habitation, and to remove in vast numbers from one country to another. In these migrations they are generally seen by thousands, travelling directly forward; while neither rocks, forests, nor even the broadest waters, can stop their progress. What I am going to relate appears so extraordinary, that were it not attested by numbers of the most credible historians, among whom are Klein and Linnæus, it might be rejected, with that scorn with which we treat imposture or credulity: however, nothing can be more true than that when these animals, in their progress, meet with broad rivers, or extensive lakes, which abound in Lapland, they take a very extraordinary method of crossing them. Upon approaching the banks, and perceiving the breadth of the water, they return, as if by common consent, into the neighbouring forest, each in quest of a piece of bark, which answers all the purposes of boats for wafting them over. When the whole company are fitted in this manner, they boldly commit their little fleet to the waves; every squirrel sitting on its own piece of bark, and fanning the air with its tail, to drive the vessel to its desired port. In this orderly manner they set forward, and often cross lakes several miles broad. But it too often happens that the poor mariners are not aware of the dangers of their navigation; for although at the edge of the water it is generally calm, in the midst it is always more turbulent. There the slightest additional gust of wind oversets the little sailor and his vessel together. The whole navy, that but a few minutes before rode proudly and securely along, is now overturned, and a shipwreck of two or three thousand sail ensues. This, which is so unfortunate for the little animal, is generally the most lucky accident in the world for the Laplander on the shore; who gathers up the dead bodies as they are thrown in by the waves, eats the flesh, and sells the skins for about a shilling the dozen.[1]

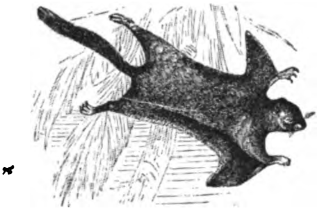
The squirrel is easily tamed,[2] and it is then a very familiar animal. It loves to lie warm, and will often creep into a man's pocket, or his bosom. It is usually kept in a box and fed with hazel nuts. Some find amusement in observing with what ease it bites the nut open, and eats the kernel. In short, it is a pleasing pretty little domestic; and its tricks and habitudes may serve to entertain a mind unequal to stronger operations.

---

[1] Œuvres de Regnard.

[2] *Squirrels in fixed cages.*—The barbarous practice of "spinning a cockchafer," provided the tail of the insect be callous, and itself void of fear, during the operation, is not a more exquisite refinement in the art of tormenting than to confine a poor squirrel in a revolving cage If there be one method more efficacious than another to deprive it of liberty, it is this very contrivance, whereby he is constituted the centre of a system;—a governor of Barataria, where, do what he will, he never can possibly be in a state of rest,—where, let him vary never so little, even for a moment, from his centrical position, everything begins tumbling about his ears. I have many times observed with pity the panting sides of an unfortunate little animal, its state of anxious tremor in its hall of torment,—its breath exhausted by galloping, kicking, and straining—worried and alarmed, without enjoying a single inch of progressive motion, or one refreshing change of attitude, for minutes together, within his tantalizing, turnabout treadmill. I know it will be said that the animal is happy, for that of exercise, the soul of nature, he has his fill. A man, pelted with mud, may believe he is hunting, or, lying on his stomach on wet grass, think it swimming, as reasonably as a poor squirrel, in the midst of a whirling maze of wood and iron, can enjoy liberty and the delight of running;—the dog, even confined by his chain, moves unmolested in a circle—the prisoner changes position in his cell;—home is home, be it ever so homely; but when the house itself turns round, its homeliness surely is destroyed altogether. I was led to these reflections when, walking in the streets of Hull, I observed a crowd of sailors busily employed in testifying their admiration and applause at some object of attention, by rude, unrestrained laughter, accompanied by many seaman-like phrases. As I approached, in order to ascertain the cause of their mirth, two squirrels were living amicably together in a common wire cage; such as is used generally for a thrush or a blackbird, furnished with perches in the usual manner, and fixed at the outside of a house, against a sunny wall. Never did a snorting horse, bounding, tossing back his mane, and galloping backwards and forwards, underneath and among the trees of an apple orchard, present a more striking contrast with the heart-broken, over-laden brute of a sandman, than at this moment these squirrels, by the variety of their movements, in comparison with the monotonous labour before alluded to; affording an exhibition that highly delighted the sailors, as particularly in accordance with their professional tastes and habits. The little creatures displayed, meanwhile, a perfection of animal activity no less pleasing to the general lover of nature and friend of the creation; each no longer the immovable centre of a circle, but figuring away in the periphery, and both together passing their hours in a state of happy companionship that baffles description. They threw summersets, ten or a dozen to-

THE FLYING SQUIRREL.[1]



Mr Ray was justly of opinion, that the flying squirrel might more properly be said to be of the rat kind, because its fur is shorter than in other squirrels, and its colours also more nearly approach the former. However, as mankind have been content to class it among the squirrels, it is scarcely worth making a new distinction in its favour. This little animal, which is frequently brought over to England, is less than a common squirrel and bigger than a field mouse. Its skin is very soft, and elegantly adorned with a dark fur in some places, and light gray in others. It has large prominent black and very sparkling eyes, small ears, and very sharp teeth, with which it gnaws any thing quickly. When it does not leap, its tail, which is pretty enough, lies close to its back; but when it takes its spring; the tail is moved backwards and forwards from side to side. It is said to partake somewhat of the nature of the squirrel, of the rat, and of the dormouse; but that in which it is distinguished from all other animals, is its peculiar conformation for taking those leaps that almost look like flying. It is indeed amazing to see it at one bound dart above a hundred yards from one tree to another. They are assisted in this spring by a very peculiar formation of the skin that extends from the fore-feet to the hinder; so that when the animal stretches its fore-legs forward and its hind-legs backward, this skin is spread out between them, somewhat like that between the legs of a bat. The surface of the body being thus increased, the little animal keeps buoyant in the air until the force of its first impulsion is expired, and then it descends. This skin, when the creature is at rest, or walking, continues wrinkled up on its sides: but when its limbs are extended, it forms a kind of web between them of above an inch broad on either side, and gives the whole body the appearance of a skin floating in the air. In this manner the flying squirrel changes place, not like a bird by repeated strokes of its wings, but rather like a paper kite, supported by the expansion of the surface of its body; but with this difference, however, that, being naturally heavier than the air, instead of mounting it descends; and that jump which upon the ground would not be above forty yards, when from a higher tree to a lower may be above a hundred.

This little animal is more common in America than in Europe, but not very common to be seen in either. It is usually found, like the squirrel, on the tops of trees; but, though better fitted for leaping, it is of a more torpid disposition, and is seldom seen to exert its powers; so that it is often seized by the pole-cat and the martin. It is easily tamed, but apt to break away whenever it finds an opportunity. It does not seem fond of nuts or almonds, like other squirrels, but is chiefly pleased with the sprouts of the birch, and the cones of the pine. It is fed in its tame state with bread and fruits; it generally sleeps by day, and is always most active by night. Some naturalists gravely caution us not to let it get among our corn fields, where, they tell us, it will do a great deal of damage, by

---

gether, over each other's backs, and round the perches, one after another; and then suddenly they would stop and change the line of direction, passing each other contrary-wise, and forming both together in the air, while in rapid motion, a double figure of eight. Let anybody try the experiment, whether lord and master, or fair mistress of a squirrel—let pity be taken upon the little shadow-tailed inhabitant of the woods—let a new cage and a suitable companion be provided, and both together in return will regale the spectator with the exhibition of feats to baffle the imagination of Ducrow; and a combination of quickness, strength, and agility, such as no other earthly creatures possess in more infinite variety.—*Sir George Head's Home Tour through the Manufacturing Districts.*

[1] There are eight species of flying squirrels, but there is only a trifling difference between them. The European squirrel differs from the American species principally in having its tail full of hair, and rounded at the end, and in the colour of its body, the upper part of which is a fine grey, and the lower white. Its whole length is about nine inches, of which the tail occupies five. The *European flying squirrel* is found in the woods of Lapland and Norway, where it feeds principally on the tender branches of the beech and pine trees. In its habits of life it differs very little from the preceding species. It always sleeps during the day-time, and seldom appears abroad in bad weather. It is active through the whole winter, being frequently caught during that season, in the traps that are laid for the grey squirrels. The females, when they have young ones, never leave their nest in pursuit of food, without previously wrapping these carefully up in the moss. They pay to them the utmost attention, brooding anxiously over them, and tenderly sheltering their bodies, by their flying membrane, from the cold.

cropping the corn as soon as it may begin to ear!

THE MARMOUT.[1]

(For representations of the Alpine Marmout, see Plate XIII. fig. 7; of Franklin's Marmout, Plate XII. fig. 45)

From the description of the squirrel and its varieties, we proceed to a different tribe of animals, no way indeed resembling the squirrel, but still something like the rabbit and the hare. We are to keep these two animals still in view as the centre of our comparison; as objects to which many others may bear some similitude, though they but little approach each other. Among the hare kind is the Marmout, which naturalists have placed either among the hare kind or the rat kind, as it suited their respective systems. In fact, it bears no great resemblance to either; but of the two it approaches nearer the hare, as well in the make of its head as in its size, in its bushy tail, and particularly in its chewing the cud, which alone is sufficient to determine our choice in giving it its present situation. How it ever came to be degraded into the rat or mouse I cannot conceive, for it no way resembles them in size, being nearly as big as a hare; or in its disposition, since no animal is more tractable, nor more easily tamed.

---

[1] This interesting little animal belongs to the order *Rodentia* and the genus *Arctomys*, and is the species with which we are best acquainted. It is classed among rats by Linnæus, and in its appearance is compared by some writers to a diminutive bear or badger; but the disposition of its teeth, and its internal conformation, evince its closer affinity to the squirrel family.

The animal, when full grown, attains the size of a rabbit, measures about fifteen inches from the nose to the root of the tail, and two feet including the tail,—and generally weighs about nine pounds. The characteristics of the genus to which it belongs are thus stated:—There are two incisors in each jaw, and ten grinders in the upper, and eight in the lower jaw; four toes, with a tubercle in place of a thumb on the fore-feet, and five toes on the hinder. The genus possesses no cheek pouches, like some others belonging to the same family; and the individual species we are considering has a thick and short body, short legs, and very short round ears; the tail differs materially from that of the squirrel, being much shorter in proportion, and straight. The head is large and thick—flattened at the top; the nose blunt and thick, and is often carried erect when the animal sits. The muzzle is furnished with whiskers, and there are long hairs also above and below each eye. The upper part of the body may be generally described as of a rather light grey colour, and the lower part of a light fawn colour. The grey darkens towards the head and tail, and the latter becomes nearly black towards the extremity. The ears are of a lighter grey than the surrounding parts. The toes of the hind feet are whitish, and those of the fore-feet black. The circuit of the muzzle is white. The fur of the animal is generally long and soft. The hairs of the tail are thicker and coarser than those of other parts, while below the tail, and inside the limbs, the hair is very short, leaving those parts almost naked.

The marmout,—organized for digging, destined for an obscure underground life, requiring for its nourishment only the herbs and roots which grow in the neighbourhood of its habitation, and finding in its subterranean retreat the means of escape from most of its enemies,—does not possess the powers of many other animals of the order to which it belongs. It cannot leap like the rat, or climb like the squirrel. It walks but slowly, and raises itself to a short distance with effort; though it mounts with more facility than it descends. It rarely climbs, however, unless in the clefts of rocks, which it then does by the alternate use of its back and legs, in the same manner that chimneys are ascended by climbing-boys. Notwithstanding this want of agility, it does not appear that the marmouts are often taken above ground, though they are usually out in sunshiny weather, in which they seem to have great enjoyment. Early in the morning the old marmouts come out of their holes, and, when the sun is higher, bring out their young ones. The latter scamper about on all sides, chase one another, and, when disposed for more quiet enjoyment, seat themselves on their hind-feet, and remain in that posture facing the sun, with an air expressive of great satisfaction. While these parties are thus amusing themselves, or busied in collecting food or materials with which to line their winter habitations, they are not unmindful of their personal safety. One of their number is posted as a sentinel upon a rock, or some other commanding spot, and if he perceives an enemy, or any unusual object that disquiets him, he sends forth a piercing cry, upon which the others retreat in all haste to their burrows, or, if these are too distant, ensconce themselves under the rocks. As they have great quickness of sight, and can discern an enemy at a great distance, they are rarely surprised.

The marmouts never assume an offensive attitude towards other animals; and when apprehensive for their safety, their first consideration is retreat. When afraid of any serious invasion, they forsake their habitations in entire families, and wander from mountain to mountain until they find a spot where they deem it eligible to construct new retreats. When, however, they are driven to the last extremity, and retreat is impracticable, they defend themselves with great spirit even against men and dogs; and with their teeth, with which they can inflict very terrible bites, and with their claws, they assail all who approach them.

The Alpine marmouts breed in the summer, and the litter usually consists of three or four young ones, and sometimes as many as six: It has not yet been ascertained whether the young, which with the parents compose a family, are the produce of two years or of one year only. If the latter, the number of the young indicates that there must be several broods in one year.

When the marmouts retreat to their cells for their winter sleep they are generally very fat, and continue so for nearly three months; but after that, they gradually decline, and are very thin by the time they awake. In their torpid state they lie in the hay close to one another, and rolled up like hedge-hogs, without exhibiting any visible appearances of life; but they may be revived by a gradual and gentle heat. From fifteen to sixteen are usually found together, and sometimes, but not often, two families are found in the same burrow; and still more rarely is one marmout found alone. During their winter sleep they are taken in great numbers, partly for the sake of their skins, which are used as furs, and partly for their flesh, which is then considered by the mountaineers as an agreeable article of food, but which is not relished by persons of more delicate appetite. The fat of the marmout, which tastes like hog's-lard, is considered by the inhabitants of the Alps to possess medicinal virtues. By the Savoyards they are chiefly taken for the purpose of exhibiting them through various parts of Europe, after they have been tamed. A young one is easily domesticated; and may with little difficulty be taught to sit upright, or to walk on its hind feet. It is sometimes even taught to dance with a stick between its paws, and to perform a great variety of feats. In its tame state the marmout will eat almost everything except flesh. When drinking, it raises its head at almost every sip, like a fowl, looking around with watchfulness and apprehension. It, however, drinks very little. Its most marked partiality is for milk and butter; and its strongest aversion is towards dogs. Unless carefully watched, it is very destructive to all kinds of provisions, clothes, linen, end furniture; and the power of its teeth is such, that no cage that is not well guarded with iron can retain it in bondage. Tame marmouts, if kept sufficiently warm, are able to dispense with their winter's sleep.—*Penny Magazine.*

The marmout is, as was said, almost as big as a hare, but it is more corpulent than a cat, and has shorter legs. Its head pretty nearly resembles that of a hare, except that its ears are much shorter. It is clothed all over with very long hair, and a shorter fur below. These are of different colours, black and gray. The length of the hair gives the body the appearance of greater corpulence than it really has, and at the same time shortens the feet, so that its belly seems touching the ground. Its tail is tufted and well furnished with hair, and it is carried in a straight direction with its body. It has five claws behind, and only four before. These it uses as the squirrel does, to carry its food to its mouth; and it usually sits upon its hinder parts to feed, in the manner of that little animal.[1]

The marmout is chiefly a native of the Alps; and when taken young is tamed more easily than any other wild animal, and almost as perfectly as any of those that are domestic. It is readily taught to dance, to wield a cudgel, and to obey the voice of its master. Like the cat, it has an antipathy to the dog; and when it becomes familiar to the family, and is sure of being supported by its master, it attacks and bites even the largest mastiff. From its squat muscular make, it has great strength, joined to great agility. It has four large cutting teeth, like all those of the hare kind, but it uses them to much more advantage, since in this animal they are very formidable weapons of defence. However, it is in general a very inoffensive animal; and, except its enmity to dogs, seems to live in friendship with every creature, unless when provoked. If not prevented, it is very apt to gnaw the furniture of a house, and even to make holes through wooden partitions; from whence, perhaps, it has been compared to the rat. As its legs are very short, and made somewhat like those of a bear, it is often seen sitting up, and even walking on its hind-legs in like manner; but with the fore-paws, as was said, it uses to feed itself in the manner of a squirrel. Like all of the hare kind, it runs much swifter up hill than down; it climbs trees with great ease, and runs up the clefts of rocks or the contiguous walls of houses with great facility. It is ludicrously said that the Savoyards, who are the only chimney-sweepers of Paris, have learned this art from the marmout, which is bred in the same country.

These animals eat indiscriminately of whatever is presented to them; flesh, bread, fruits, herbs, roots, pulse, and insects. But they are particularly fond of milk and butter. Although less inclined to petty thefts than the cat, yet they always try to steal into the dairy, where they lap up the milk like a cat, purring all the while like that animal, as an expression of their being pleased. As to the rest, milk is the only liquor they like. They seldom drink water and refuse wine. When pleased or caressed, they often yelp like puppies; but when irritated or frighted, they have a piercing note that hurts the ear. They are very cleanly animals, and like the cat retire upon necessary occasions; but their bodies have a disagreeable scent, particularly in the heat of summer. This tinctures their flesh, which being very fat and firm, would be very good, were not this flavour always found to predominate.

We have hitherto been describing affections in this animal which it has in common with many others ; but we now come to one which particularly distinguishes it from all others of this kind, and indeed, from every other quadruped, except the bat and the dormouse; this is its sleeping during the winter. The marmout, though a native of the highest mountains, and where the snow is never wholly melted, nevertheless seems to feel the influence of the cold more than any other, and in a manner has all its faculties chilled up in winter. This extraordinary suspension of life and motion for more than half the year, deserves our wonder, and excites our attention to consider the manner of such temporary death, and the subsequent revival. But first to describe, before we attempt to discuss.

The marmout, usually at the end of September, or the beginning of October, prepares to fit up its habitation for the winter, from which it is never seen to issue till about the beginning or the middle of April. This animal's little retreat is made with great precaution, and fitted up with art. It is a hole on the side of a mountain, extremely deep, with a spacious apartment at the bottom, which is rather longer than it is broad. In this several marmouts can reside at the same time, without crowding each other, or injuring the air they breathe. The feet and claws of this animal seem made for digging; and, in fact, they burrow into the ground with amazing facility, scraping up the earth like a rabbit, and throwing back what they have thus loosened behind them. But the form of their hole, is still more wonderful; it resembles the letter Y; the two branches being two openings, which conduct into one channel, which terminates in their general apartment that lies at the bottom. As the hole is made on the declivity of a mountain, there is no part of it on a level but the apartment at the end. One of the branches or openings issues out sloping downwards; and this serves as a kind of sink or drain to the whole family, where they make their excrements, and where the moisture of the place is drawn away. The other branch, on the contrary, slopes upwards, and this serves as their door, upon which to go out and in. The apartment at the end is very warmly stuccoed round with moss and hay, of both which they make an ample provision during the summer. As this is a work of great labour, so it is undertaken in common; some cut the finest grass, others gather it, and others take their turns to drag it into their hole. Upon this occasion, as we are told, one of them lies on its back, permits the hay to be heaped upon its belly, keeps its paws upright to make greater room; and in this manner, lying still upon its back, it is dragged by the tail, hay and all, to their common retreat. This also some give as a reason for the hair being generally worn away on their backs, as is usually the case; however, a better reason for this may be assigned, from their continually rooting up holes, and passing through narrow openings. But be this as it will, certain it is that they all live together, and work in common to make their habitation as snug and convenient as possible. In it they pass three parts of their lives; into it they retire when the storm is high; in it they continue while it rains; there they remain when apprehensive of danger, and never stir out except in fine weather, never going far from home even then. Whenever they venture abroad, one is placed as a sentinel, sitting upon a lofty rock, while the rest amuse themselves in playing along green fields, or are employed in cutting the grass and making hay for their winter's convenience. Their trusty sentinel, when an enemy, a man, a dog, or a bird of prey approaches, apprises its companions with a whistle, upon which they all make home, the sentinel himself bringing up the rear.

---

[1] Buffon, from whence the remainder of this description is taken. *N. B.* He takes it from Gesner, vol. xvii. —*Goldsmith.*

But it must not be supposed that this hay is designed for provision; on the contrary, it is always found in as great plenty in their holes at the end as at the beginning of winter; it is only sought for the convenience of their lodging, and the advantages of their young. As to provision, they seem kindly apprised by Nature that during the winter they shall not want any; so that they make no preparations for food, though so diligently employed in fitting up their abode. As soon as they perceive the first approaches of the winter, during which their vital motions are to continue in some measure suspended, they labour very diligently to close up the two entrances of their habitation, which they effect with such solidity, that it is easier to dig up the earth any where else than where they have closed it. At that time they are very fat, and some of them are found to weigh above twenty pounds; they continue so for even three months more; but by degrees their flesh begins to waste, and they are usually very lean by the end of winter. When their retreat is opened, the whole family is then discovered, each rolled into a ball, and covered up under hay. In this state they seem entirely lifeless; they may be taken away, and even killed without their testifying any great pain; and those who find them in this manner, carry them home, in order to breed up the young and eat the old ones. A gradual and gentle warmth revives them; but they would die if too suddenly brought near the fire, or if their juices were too quickly liquefied.

Strictly speaking, says Mr Buffon, these animals cannot be said to sleep during the winter; it may be called rather a *torpor*, a stagnation of all the faculties.[1] This torpor is produced by the congelation of their blood, which is naturally much colder than that of all other quadrupeds. The usual heat of man and other animals is about thirty degrees above congelation; the heat of these is not above ten degrees. Their internal heat is seldom greater than that of the temperature of the air. This has been often tried by plunging the ball of the thermometer into the body of a living dormouse, and it never rose beyond its usual pitch in air, and sometimes it sunk above a degree. It is not surprising, therefore, that these animals, whose blood is so cold naturally, should become torpid, when the external cold is too powerful for the small quantity of heat in their bodies yet remaining, and this always happens when the thermometer is not more than ten degrees above congelation. This coldness Mr Buffon has experienced in the blood of the bat, the dormouse, and the hedge-hog, and with great justice he extends the analogy to the marmout, which, like the rest, is seen to sleep all the winter. This torpid state continues as long as the cause which produces it continues: and it is very probable that it might be lengthened out beyond its usual term, by artificially prolonging the cold: if, for instance, the animal were rolled up in wool, and placed in a cold cellar, nearly approaching to, but not quite so cold as an icehouse, for that would kill them outright, it would remain perhaps a whole year in its state of insensibility. However this be, if the heat of the air be above ten degrees, these animals are seen to revive; and if it be continued in that degree of temperature, they do not become torpid, but eat and sleep at proper intervals, like all other quadrupeds whatever.

---

[1] Buffon, vol. xvi. Loirs.

From the above account we may form some conception of the state in which these animals continue during the winter. As in some disorders, where the circulation is extremely languid, the appetite is diminished in proportion, so in these the blood scarcely moving, or only moving in the greater vessels, they want no nourishment to repair what is worn away by its motions. They are seen, indeed by slow degrees to become leaner in proportion to the slow attrition of their fluids; but this is not perceptible, except at the end of some months. Man is often known to gather nourishment from the ambient air; and these also may, in some measure, be supplied in the same manner; and having sufficient motion in their fluids to keep them from putrefaction, and just sufficient nourishment to supply the waste of their languid circulation, they continue rather feebly alive than sleeping.

These animals produce but once a-year, and usually bring forth but three or four at a time. They grow very fast, and the extent of their lives is not above nine or ten years; so that the species is neither numerous nor very much diffused. They are chiefly found in the Alps, where they seem to prefer the brow of the highest mountains to the lowest ranges, and the sunny side to that in the shade. The inhabitants of the country where they chiefly reside, when they observe the hole, generally stay till winter before they think proper to open it; for if they begin too soon, the animal wakes, and as it has a surprising faculty of digging, makes its hole deeper in proportion as they follow. Such as kill it for food, use every art to improve the flesh, which is said to have a wild taste, and to cause vomitings.[1] They, therefore, take away the fat, which is in great abundance, and salt the remainder, drying it somewhat in the manner of bacon. Still, however, it is said to be very indifferent eating. This animal is found in Poland under the denomination of the *Bobak*, entirely resembling that of the Alps, except that the latter has a toe more upon its forefoot than the former. It is found also in Siberia under the name of the *Jevraska*, being rather smaller than either of the other two. Lastly, it is found in Canada by the appellation of the *Monax*, differing only from the rest in having a bluish snout and a longer tail.

THE AGOUTI.[2]

From the marmout, which differs from the hare so much in the length of its fur, we go to the Agouti, another species equally differing in the shortness of its hair. These bear some rude resemblance to the hare and the rabbit in their form and manner of living, but sufficiently differing to require a particular description. The first of these, and that the largest, as was hinted above, is called the *agouti*. This animal is found in great abundance in the southern parts of America, and has by some been called the *rabbit* of that continent. But, though in many respects it resembles the rabbit, yet still in many more it differs, and is, without all doubt, an animal peculiar to the new world only. The agouti is about the size of a rabbit, and has a head very much resembling it, except that the ears are very short in comparison. It resembles the rabbit also in the arched form of its back, in the hind legs being longer than the fore, and in having four great cutting-teeth, two above and two below; but then it differs in the nature of its hair, which is not soft and downy as in the rabbit, but hard and bristly like that of a sucking pig, and of a reddish-brown colour. It differs also in the tail, which is even shorter than the rabbit, and entirely destitute of hair. Lastly, it differs in the number of its toes, having but three in the hinder feet, whereas the rabbit has five. All these distinctions, however, do not countervail against its general form, which resembles that of a rabbit, and most travellers have called it by that name.

As this animal differs in form, it differs still more in habitudes and disposition. As it has the hair of a hog, so also it has its voraciousness. It eats indiscriminately of all things; and, when satiated, hides the remainder, like the dog or the fox, for a future occasion. It takes a pleasure in gnawing and spoiling every thing it comes near. When irritated, its hair stands erect along the back, and, like the rabbit, it strikes the ground violently with its hind feet. It does not dig a hole in the ground, but burrows in the hollows of trees. Its ordinary food consists of the roots of the country, potatoes, and yams, and such fruits as fall from the trees in autumn. It uses its fore-paws, like the squirrel, to carry its food to its mouth: and as its hind feet are longer than the fore, it runs very swiftly upon plain ground or up a hill, but upon a descent it is in danger of falling. Its sight is excellent, and its hearing equals that of any other animal; whenever it is whistled to, it stops to hearken. The flesh of such as are fat and well fed is tolerable food, although it has a peculiar taste, and is a little tough. The French dress it like a sucking-pig, as we learn from Mr Buffon's account; but the English dress it with a pudding in its belly, like a hare. It is hunted by dogs; and whenever it has got into a sugar-ground, where the canes cover the place, it is easily overtaken, for it is embarassed every step it takes, so that a man may easily come up with it without any other assistance. When in the open country, it usually runs with great swiftness before the dogs, until it gains its retreat, within which it continues to hide, and nothing but filling the hole with smoke can force it out. For this purpose, the hunter burns fagots or straw at the entrance, and conducts the smoke in such a manner that it fills the whole cavity. While this is doing, the poor little animal seems sensible of its danger, and begs for quarter with a most plaintive cry, seldom quitting its hole till the utmost extremity. At last, when half-suffocated, it issues out, and trusts once more to its speed for protection. When still forced by the dogs, and incapable of making good a retreat, it turns upon the hunters, and with its hair bristling like a hog, and standing upon its hind-feet, it defends itself very obstinately. Sometimes it bites the legs of those that attempt to take it, and will take out the piece wherever it fixes its teeth.[1]

---

[1] Dictionnaire Raisonnée, vol. iii. p. 29.

[2] This animal, together with the Paca, Aperea, Guinea Pig, Capibara, and a few other species, are now arranged under the general appellation of Cavy. They are distinguished by having two wedge-shaped front teeth in each jaw, and eight grinders on each side in both jaws; they have from four to six toes on the fore-feet, and from three to five on the hinder: the tail is very short or none, and they have no collar-bones. For representations of the Agouti, see Plate XIII. fig. 17; of the Capibara, Plate XII. fig. 47; of the Paca, Plate XIII. fig. 50; and of the Guinea-pig, Plate XIII. fig. 16.

Its cry when disturbed or provoked, resembles that of a sucking-pig. If taken young, it is easily tamed, continues to play harmlessly about the house, and goes out and returns of its own accord. In a savage state it usually continues in the woods, and the female generally chooses the most obscure parts to bring forth her young. She there prepares a bed of leaves and dry grass, and generally brings forth two at a time. She breeds twice or thrice a-year, and carries her young from one place to another, as convenience requires, in the manner of a cat. She generally lodges them, when three days old, in the hollow of a tree, suckling them but a very short time; for they soon come to perfection, and it should consequently follow that they soon grow old.

THE PACA.

The Paca is also an animal of South America, very much resembling the former, and like it has received the name of the *American rabbit*, but with as little propriety. It is about the size of a hare, or rather larger, and in figure somewhat like a sucking pig, which it also resembles in its grunting and its manner of eating. It is, however, most like the agouti, although it differs in several particulars. Like the agouti, it is covered rather with coarse hair than a downy fur. But then it is beautifully marked along the sides with small ash-coloured spots, upon an amber-coloured ground; whereas the agouti is pretty much of one reddish colour. The paca is rather more thick and corpulent than the agouti; its nose is shorter, and its hind-feet have five toes; whereas the agouti has but three. As to the rest, this animal bears some distant resemblance to a rabbit, the ears are naked of hair, and somewhat sharp, the upper jaw is somewhat longer than the lower, the teeth, the shape of the head, and the size of it, are like to those of a rabbit. It has a short tail likewise, though not tufted; and its hinder legs are longer than the fore. It also burrows in the ground like that animal, and from this similitude alone, travellers might have given it the name.

The paca does not make use of its fore-paws, like the squirrel or the agouti, to carry its food to the mouth, but hunts for it on the ground, and roots like a hog. It is generally seen along the banks of rivers, and is only to be found in the moist and warm countries of South America. It is a very fat animal, and in this respect much preferable to the agouti, that is most commonly found lean. It is eaten, skin and all, like a young pig, and is considered as a great delicacy. Like the former little animal, it defends itself to the last extremity, and is very seldom taken alive. It is persecuted not only by man, but by every beast and bird of prey, who all watch its motions, and, if it ventures at any distance from its hole, are sure to seize it. But although the race of these little animals is thus continually destroyed, it finds some refuge in its hole, from the general combination; nd breeds in such numbers, that the diminution is not perceptible.

To these animals may be added others, very similar, both in form and disposition; each known by its particular name in its native country, but which travellers have been contented to call rabbits or hares; of which we have but indistinct notice. The TAPETI, or the BRASILIAN RABBIT, is in shape like our English ones, but is much less, being said to be not above twice the size of a dormouse. It is reddish on the forehead, and a little whitish under the throat. It is remarkable for having no tail; but it has long ears, with whiskers, like our rabbits, and black eyes. It does not burrow, like ours; but lives at large, like the hare.

---

[1] Ray's Synop.

The APEREA is called also by some the BRASILIAN RABBIT, being an animal that seems to partake of the nature of a rabbit and a rat. The ears are like those of a rat, being short and round; but the other parts are like those of a rabbit, except that it has but three toes on the hinder legs, like the agouti.

To these imperfect sketches of animals little known, others less known might be added; for as nature becomes more diminutive, her operations are less attentively regarded. I shall only, therefore, add one animal more to this class, and that very well known; I mean the Guinea-pig; which Brisson places among those of the rabbit kind; and as I do not know any other set of animals with which it can be so well compared, I will take leave to follow his example.

THE GUINEA-PIG.

The guinea-pig is a native of the warmer climates; but has been so long rendered domestic, and so widely diffused, that it has now become common in every part of the world. There are few unacquainted with the figure of this little animal; in some places it is considered as the principal favourite; and is often found even to displace the lap-dog. It is less than a rabbit, and its legs are shorter; they are scarcely seen, except when it moves; and the neck also is so short, that the head seems stuck upon the shoulders. The ears are short, thin, and transparent; the hair is like that of a sucking-pig, from whence it has taken the name; and it wants even the vestiges of a tail. In other respects, it has some similitude to the rabbit. When it moves, its body lengthens like that animal; and when it is at rest, it gathers up in the same manner. Its nose is formed with the rabbit lip, except that its nostrils are much farther asunder. Like all other animals in a domestic state, its colours are different; some are white, some are red, and others both red and white. It differs from the rabbit in the number of its toes, having four toes on the feet before, and but three on those behind. It strokes its head with the forefeet, like the rabbit; and, like it, sits upon the hind-feet; for which purpose there is a naked callous skin on the back part of the legs and feet.

These animals are, of all others the most helpless and inoffensive.[1] They are scarcely possessed of courage sufficient to defend themselves against the meanest of all quadrupeds, a mouse. Their only animosity is exerted against each other; for they will often fight very obstinately; and the stronger is often known to destroy the weaker. But against all other aggressors, their only remedy is patience and non-resistance. How, therefore, these animals, in a savage state, could contrive to protect themselves, I have not been able to learn; as they want strength, swiftness, and even the natural instinct so common to almost every other creature.

As to their manner of living among us, they owe their lives entirely to our unceasing protection. They must be constantly attended, shielded from the excessive colds of the winter, and secured against all other domestic animals, which are apt to attack them, from every motive, either of appetite, jealousy, or experience of their pusillanimous nature. Such, indeed, is their stupidity, that they suffer themselves to be devoured by the cats without resistance; and, differing from all other creatures, the female sees her young destroyed without once attempting to protect them. Their usual food is bran, parsley, or cabbage leaves, but there is scarce a vegetable cultivated in our gardens that they will not gladly devour. The carrot-top is a peculiar dainty, as also salad; and those who would preserve their healths, would do right to vary their food; for if they be continued on a kind too succulent or too dry, the effects are quickly perceived upon their constitution. When fed upon recent vegetables, they seldom drink. But it often happens that, conducted by nature, they seek drier food, when the former disagrees with them. They then gnaw clothes, paper, or whatever of this kind they meet with; and on these occasions they are seen to drink like most other animals, which they do by lapping. They are chiefly fond of new milk; but, in case of necessity, are content with water.

They move pretty much in the manner of rabbits, though not near so swiftly; and when confined in a room, seldom cross the floor, but generally keep along the wall. The male usually drives the female on before him, for they never move abreast together, but constantly the one seems to tread in the footsteps of the preceding. They chiefly seek for the darkest recesses, and the most intricate retreats; where, if hay be spread as a bed for them, they continue to sleep together, and seldom venture out but when they suppose all interruption removed. On these occasions they act as rabbits; they swiftly move forward from their bed, stop at the entrance, listen, look round, and, if they perceive the slightest approach of danger, they run back with precipitation. In very cold weather, however, they are more active, and run about in order to keep themselves warm.

---

[1] This history is partly taken from the Amœnitates Academicæ, vol. iv. p. 202.—*Goldsmith.*

They are a very cleanly animal, and very different from that whose name they go by. If the young ones happen to fall into the dirt, or be any other way discomposed, the female takes such an aversion to them, that she never permits them to visit her more. Indeed, her whole employment, as well as that of the male, seems to consist in smoothing their skins, in disposing their hair, and improving its gloss. The male and female take this office by turns; and when they have thus brushed up each other, they then bestow all their concern on their young, taking particular care to make their hair lie smooth, and biting them if they appear refractory. As they are so solicitous for elegance themselves, the place where they are kept must be regularly cleaned, and a new bed of hay provided for them at least every week. Being natives of a warm climate, they are naturally chilly in ours; cleanliness, therefore, assists warmth and expels moisture. They may be thus reared, without the aid of any artificial heat; but, in general, there is no keeping them from the fire in winter, if they be once permitted to approach it.

When they go to sleep, they lie flat on their bellies, pretty much in their usual posture; except that they love to have their fore-feet higher than their hinder. For this purpose they turn themselves several times round before they lie down, to find the most convenient situation. They sleep like the hare, with their eyes half open; and continue extremely watchful, if they suspect danger. The male and female are never seen both asleep at the same time; but while he enjoys his repose, she remains upon the watch silently continuing to guard him, and her head turned towards the place where he lies. When she supposes that he has had his turn, she then awakes him with a kind of murmuring noise, goes to him, forces him from his bed, and lies down in his place. He then performs the same good turn for her; and continues watchful till she also has done sleeping.

These animals are exceedingly salacious, and generally are capable of coupling at six weeks old. The female never goes with young above five weeks; and usually brings forth from three to five at a time; and this not without pain. But what is very extraordinary, the female admits the male the very day she has brought forth, and becomes again pregnant; so that their multiplication is astonishing. She suckles her young but about twelve or fifteen days; and during that time does not seem to know her own; for if the young of any other be brought, though much older, she never drives them away, but suffers them even to drain her, to the disadvantage of her own immediate offspring. They are produced with the eyes open, like all others of the hare kind; and in about twelve hours, equal even to the dam in agility. Although the dam has but two teats, yet she abundantly supplies them with milk; and they are also capable of feeding upon vegetables, almost from the very beginning. If the young ones are permitted to continue together, the stronger, as in all other societies, soon begin to govern the weak. Their contentions are often long and obstinate; and their jealousies very apparent. Their disputes are usually for the warmest place, or the most agreeable food. If one of them happens to be more fortunate in this respect than the rest, the strongest generally comes to dispossess it of its advantageous situation. Their manner of fighting, though terrible to them, is ridiculous enough to a spectator. One of them seizes the hair on the nape of the other's neck with its fore-teeth, and attempts to tear it away; the other to retaliate, turns its hinder parts to the enemy, and kicks up behind like a horse, and with its hinder claws scratches the sides of its adversary; so that sometimes they cover each other with blood. When they contend in this manner, they gnash their teeth pretty loudly, and this is often a denunciation of mutual resentment.

These, though so formidable to each other, yet are the most timorous creatures upon earth, with respect to the rest of animated nature: a falling leaf disturbs them, and every animal overcomes them. From hence they are difficultly tamed; and will suffer none to approach them, except the person by whom they are fed. Their manner of eating is something like that of the rabbit; and, like it, they appear also to chew the cud. Although they seldom drink, they make water every minute. They grunt somewhat like a young pig; and have a more piercing note to express pain. In a word, they do no injury; but then, except the pleasure they afford the spectator, they are of very little benefit to mankind. Some, indeed, dress and eat them; but their flesh is indifferent food, and by no means a reward for the trouble of rearing them. This, perhaps, might be improved, by keeping them in a proper warren, and not suffering them to become domestic: however, the advantages that would result from this would be few, and the trouble great; so that it is likely they will continue a useless, inoffensive dependent, rather propagated to satisfy caprice than to supply necessity.

A
HISTORY OF ANIMALS.

BOOK VI.

ANIMALS OF THE RAT, HEDGEHOG, ETC., KINDS.

CHAP I.

THE RAT KIND.[1]

Were it necessary to distinguish animals of the rat kind from all others, we might describe them as having two large cutting teeth, like the hare kind, in each jaw; as covered with hair; and as not ruminating. These distinctions might serve to guide us, had we not too near an acquaintance with this noxious race to be mistaken in their kind. Their numbers, their minuteness, their vicinity, their vast multiplication, all sufficiently contribute to press them upon our observation, and remind us of their existence. Indeed, if we look through the different ranks of animals, from the largest to the smallest, from the great elephant to the diminutive mouse, we shall find that we suffer greater injuries from the contemptible meanness of the one, than the formidable invasions of the other. Against the elephant, the rhinoceros, or the lion, we can oppose united strength, and by art make up the deficiencies of natural power: these we have driven into their native solitudes, and obliged to continue at a distance, in the most inconvenient regions and unhealthful climates. But it is otherwise with the little teasing race I am now describing: no force can be exerted against their unresisting timidity; no arts can diminish their amazing propagation: millions may be at once destroyed, and yet the breach be repaired in the space of a very few weeks; and in proportion as nature has denied them force, it has supplied the defect by their fecundity.

THE GREAT RAT.

The animal best known at present, and in every respect the most mischievous, is the great rat; which, though but a new comer into this country, has taken too secure a possession to be ever removed. This hateful and rapacious creature, though sometimes called the *rat of Norway*, is utterly unknown in all the northern countries, and, by the best accounts I can learn, comes originally from the Levant. Its first arrival, as I am assured, was upon the coasts of Ireland, in those ships that traded in provisions to Gibraltar; and perhaps we owe to a single pair of these animals, the numerous progeny that now infests the whole extent of the British empire.

This animal, which is called by Mr Buffon the *surmulot*, is in length about nine inches; its eyes are large and black; the colour of the head, and the whole upper part of the body, is of a light brown, mixed with a tawny and ash colour. The end of the nose, the throat and belly, are of a dirty white, inclining to gray; the feet and legs are almost bare, and of a dirty pale flesh colour; the tail is as long as the body, covered with minute dusky scales mixed with a few hairs, and adds to the general deformity of its detestable figure. It is chiefly in the colour that this animal differs from the *black rat*, or the *common rat*, as it was once called: but now common no longer,

---

[1] These have the upper front teeth wedge-shaped, three grinders on each side in each jaw, though sometimes only two, and have perfect collar bones. In Turton's Linne, forty-six species are described, besides varieties.

This new invader, in a very few years after its arrival, found means to destroy almost the whole species, and to possess itself of their retreats.

But it was not against the black rat alone that its rapacity was directed; all other animals of inferior strength shared the same misfortunes. The contest with the black rat was of short continuance.[1] As it was unable to contend, and had no holes to fly to for retreat, but where its voracious enemy could pursue, the whole race was soon extinguished. The frog also was an animal equally incapable of combat or defence. It had been designedly introduced into the kingdom of Ireland some years before the Norway rat; and it was seen to multiply amazingly. The inhabitants were pleased with the propagation of a harmless animal, that served to rid their fields of insects; and even the prejudices of the people were in its favour, as they supposed that the frog contributed to render their waters more wholesome. But the Norway rat soon put a stop to their increase; as these animals were of an amphibious nature, they pursued the frog to its lakes, and took it even in its own natural element. I am, therefore, assured, that the frog is once more almost extinct in that kingdom; and that the Norway rat, having no more enemies left there to destroy, is grown less numerous also.

We are not likely, therefore, to gain by the destruction of our old domestics, since they are replaced by such mischievous successors. The Norway rat has the same disposition to injure us, with much greater power of mischief. It burrows in the banks of rivers, ponds, and ditches; and is every year known to do incredible damage to those mounds that are raised to conduct streams, or to prevent rivers from overflowing. In these holes, which it forms pretty near the edge of the water, it chiefly resides during the summer, where it lives upon small animals, fish, and corn. At the approach of winter, it comes nearer the farm-houses, burrows in their corn, eats much, and damages still more than it consumes. But nothing that can be eaten seems to escape its voracity. It destroys rabbits, poultry, and all kinds of game; and, like the pole-cat, kills much more than it can carry away. It swims with great ease, dives with great celerity, and easily thins the fish-pond. In short, scarcely any of the feebler animals escape its rapacity, except the mouse, which shelters itself in its little hole, where the Norway rat is too big to follow.

These animals frequently produce from ten to fifteen at a time;[2] and usually bring forth three times a-year. This great increase would quickly be found to overrun the whole country, and render our assiduity to destroy them fruitless, were it not, happily for us, that they eat and destroy each other. The same insatiable appetite that impels them to indiscriminate carnage, also incites the strongest to devour the weakest, even of their own kind. The large male rat generally keeps in a hole by itself, and is as dreaded by its own species, as the most formidable enemy. In this manner the number of these vermin is kept within due bounds; and when their increase becomes injurious to us, it is repressed by their own rapacity.

But beside their own enmities among each other, all the stronger carnivorous quadrupeds have natural antipathies against them. The dog, though he detests their flesh, yet openly declares his alacrity to pursue them; and attacks them with great animosity. Such as are trained up to killing these vermin, despatch them often with a single squeeze: but those dogs that show any hesitation, are sure to come off but indifferently; for the rat always takes the advantage of a moment's delay, and, instead of waiting for the attack, becomes the aggressor, seizing its pursuer by the lip, and inflicting a very painful and dangerous wound. From the inflammation, and other angry symptoms that attend this animal's bite, some have been led to think that it was in some measure venomous; but it is likely that the difficulty of the wound's healing, arises merely from its being deep, and lacerated by the teeth, and is rather a consequence of the figure of the instruments that inflict it, than any venom they may be supposed to possess.

The cat is another formidable enemy of this kind; and yet the generality of our cats neither care to attack it, nor to feed upon it when killed. The cat is a more prudent hunter than the dog, and will not be at the pains to take or combat with an enemy that is not likely to repay her time and danger. Some cats, however, will pursue and take the rat; though often not without an obstinate resistance. If hungry, the cat will sometimes eat the head; but, in general, she is content merely with her victory.

A foe much more dangerous to these vermin is the weasel. This animal pursues them with avidity, and being pretty nearly of their own size, follows them into their holes, where a desperate combat ensues. The strength of each is pretty near equal; but the arms are very different. The rat, furnished with four long tusks at the extremity of its jaw, rather snaps than bites; but the weasel, where it once fastens, holds, and continuing also to suck the blood at the same time, weakens its antagonist, and always obtains the victory. Mankind have contrived several other methods of destroying these noxious intruders; ferrets, traps, and particularly poison; but of all other poisons, I am told that the nux vomica, ground and mixed with meal, is the most certain as it is the least dangerous.

---

[1] Naturalists now doubt whether enmity exists between the brown and black rat. See note 1. p. 450.

[2] Buffon, vol. xvii. p. 2.

To this species I will subjoin as a variety, the BLACK RAT,[1] mentioned above, greatly resembling the former in figure, but very distinct in nature, as appears from their mutual antipathy. This animal was formerly as mischievous as it was common; but at present it is almost utterly extirpated by the great rat, one malady often expelling another. It is become so scarce, that I do not remember ever to have seen one. It is said to be possessed of all the voracious and unnatural appetites of the former: though, as it is less, they may probably be less noxious. Its length is about seven inches; and the tail is near eight inches long. The colour of the body is of a deep iron gray, bordering upon black, except the belly, which is of a dirty cinereous hue. They have propagated in America in great numbers, being originally introduced from Europe; and as they seem to keep their ground wherever they get footing, they are now become the most noxious animals in that part of the world.[2]

---

[1] The black rat is a smaller animal than its congener, and is neither so prolific nor so voracious, though it commits great devastations, in proportion to its size, whenever it can find an entrance into houses, barns, or granaries. Dr Fleming states, that they bring forth eleven young ones at a litter, and mentions that he has evidence of their pulling off the hair from the necks of cows to line their nests. It is hardly a burrowing animal, and in old-fashioned country houses used to live chiefly in holes of the thatch or turf of which the roofs in those days were usually formed. The brown rat, on the other hand, burrows deep in the earth, and often seeks security for its nest beneath the very foundation-stones of houses. The quantity of earth, stones, and rubbish, which they will cast up in forming one of these dens of refuge, is quite incredible; and it often seems impossible to eradicate them without taking down the wall. Their habits lead them also to take refuge in the sewers of towns, the drains made under gentlemen's houses, and other concealed places, particularly where there is foul water. The female frequently brings forth nineteen at a litter. Though this last-mentioned species does not mix with the common or black rat, and even may sometimes destroy it, yet the natural antipathy commonly supposed to exist between them is an error. The Surmulots or Brown Rats do not necessarily exclude the black rats from their vicinity, nay, the two species often live under the shelter, and in contiguous burrows. This occurs when the place of their establishment affords food in abundance, and excludes the necessity of mutual warfare for subsistence. In the contrary case, we find that the surmulots not only destroy the black rats, but that the latter, as is well known, will devour one another. Brown rats swim with ease, and can seek their prey by water as well as by land. They infest ships and harbours to a most annoying degree, and can hardly be eradicated: in warm climates, steam has sometimes been employed to destroy them in ships; the hatches being closed, and the vapour admitted till the animals are boiled to a pulp. We have heard of an American captain who adopted a very ingenious but less creditable plan. Having been almost eaten up by these creatures in his ship for some years, he took an opportunity one voyage, after delivering his cargo in Holland, to lay a plank from his own vessel to that of a countryman, who had just finished loading a cargo of cheese; the greedy sagacity of the rats led them instantly to discover the communication, and before morning next day, there was not one of them remaining in his ship. By removing the plank, he of course took care they should not resume their old quarters; and so by a cruel trick he rid himself of this voracious colony of rats. The propensity of rats to desert a *bare* or *falling* habitation for a better provided or surer, has passed into a satirical proverb in the English language.

[2] "The most interesting account of rats I have met with, was made some time ago in an official report to the French government. It was drawn up in consequence of a proposition made for the removal of the horse slaughter-house, at Montfaucon, to a greater distance from Paris, when one of the chief obstacles urged against such a removal, was the fear entertained of the dangerous consequences that might result to the neighbourhood, from suddenly depriving these voracious vermin of their accustomed sustenance. The report goes on to state that the carcasses of the horses killed in the course of a day, and sometimes these amounted to thirty-five, are found the next morning picked bare to the bone. Dussausois, a proprietor of one of the slaughter-houses, has, however, made a still more conclusive experiment. A part of his establishment is enclosed by solid walls, at the foot of which are several holes made for the ingress and egress of the rats. Into this enclosure he put the carcasses of two or three horses, and towards the middle of the night, having first cautiously, and with as little noise as possible, stopped up all the holes, he got together several of his workmen, each having a torch in one hand, and a stick in the other. Having entered the yard, and closed the door behind them, they commenced a general massacre. It was not necessary to take any aim, for, no matter how the blow was directed, it was sure to immolate a rat, and those who endeavoured to escape by climbing up the walls were quickly knocked down. By a recurrence of this experiment at intervals of a few days, he killed in the space of a month 16,050 rats. After one night's massacre, the dead amounted to 2650, and the result of four hunts was 9101. Even this can give but an imperfect idea of the number of these vermin, for the enclosure in which they were thus killed contains not above the twentieth part of the space over which the dead bodies of horses are spread, and which it is but fair to suppose must equally attract the rats upon all points. These animals have made burrows for themselves, like rabbits, in the adjoining fields, and hollowed out into catacombs all the surrounding eminences, and that to such an extent, that it is not unusual to see the latter crumble away at the base, and leave these subterraneous works exposed. So great is the number of these animals, that they have not all been able to lodge themselves in the immediate vicinity of the slaughter-houses, for paths may be distinctly traced leading across the fields, from the enclosures in which the horses are killed, to a burrow about five hundred paces distant. These paths are particularly remarkable in wet weather, being covered with a clayey mud, which adheres to the feet of the rat on running out of the burrows.

The predilection these animals show to one particular part of a horse is curious. They invariably begin by devouring the eyes, drinking the liquid contained in

To this also we may subjoin the **BLACK WATER RAT**, about the same size with the latter, with a larger head, a blunter nose, less eyes, and shorter ears, and the tip of its tail a little white. It was supposed by Ray to be web-footed; but this has been found to be a mistake, its toes pretty much resembling those of its kind. It never frequents houses; but is usually found on the banks of rivers, ditches, and ponds, where it burrows and breeds. It feeds on fish, frogs, and insects; and in some countries it is eaten on fasting days.[1]

An animal equally mischievous, and equally well known with the former, is the mouse. Timid, cautious, and active, all its dispositions are similar to those of the rat, except with fewer powers of doing mischief.[2] Fearful by nature, but familiar from necessity, it attends upon mankind, comes an unbidden guest to his most delicate entertainments. Fear and necessity seem to regulate all its motions; it never leaves its hole but to seek provision, and seldom ventures above a few paces from home. Different from the rat, it does not go from one house to another, unless it be forced; and as it is more easily satisfied, it does much less mischief.

Almost all animals are tamed more difficultly in proportion to the cowardice of their natures. The truly bold and courageous easily become familiar, but those that are always fearful are ever suspicious. The mouse being the most feeble, and consequently the most timid of all quadrupeds, except the Guinea-pig, is never rendered thoroughly familiar; and, even though fed in a cage, retains its natural apprehensions.[3] In fact, it is to these alone that it owes its security.[4] No animal has more enemies, and few so incapable of resistance. The owl, the cat, the snake, the hawk, the weasel, the rat itself, destroy this species by millions, and it only subsists by its amazing fecundity.

The mouse brings forth at all seasons, and several times in a year.[5] Its usual number is from six to ten. These in less than a fortnight are strong enough to run about and shift for themselves. They are chiefly found in farmers' yards and among their corn, but are seldom in those ricks that are much infested with rats. They generally choose the south-west side of the rick,

---

them, and eating the fat at the bottom of the orbit. There has not been one instance of a dead horse left one night exposed, the eyes of which were not devoured before morning.

During very severe frosts, when it becomes impossible to flay and cut up the bodies of horses that have been for any time exposed to the air, and when even the fragments of flesh lying about have become so hard as to render it difficult for the rats to feed upon them, they resort to the following expedient:—They penetrate into the body, and there establish themselves, and devour the flesh, so that, when the thaw comes, the workmen find nothing but a skin and a skeleton underneath, as clean and clear of flesh as if it had been prepared by the most skilful operator.

Their ferocity as well as their voracity surpass any thing that can be imagined, to prove which the following fact was stated:—Mons. Magendie, having gone himself to Montfaucon to procure twelve rats upon which to make experiments, had them put together into a box. On his return home, he opened the box, and found but three rats, the others having been devoured by the survivors, and nothing remained of them but their tails and bones. The fact appears incredible, but the reporters declare that they had it from Mons. Magendie's lips."—*Jesse's Gleanings in Natural History.*

[1] Dr Shaw, in his General Zoology, informs us that a gentleman travelling through Mecklenburg about thirty years ago, was witness to the following curious circumstance in the post-house at new Stargard. After dinner the landlord placed on the floor a large dish of soup, and gave a loud whistle. Immediately there came into the room a mastiff, a fine Angora cat, an old raven, and a remarkably large rat with a bell about its neck. The four animals went to the dish, and, without disturbing each other, fed together; after which the dog, cat, and rat, lay before the fire, while the raven hopped about the room. The landlord, after accounting for the familiarity which existed among the animals, informed his guest that the rat was the most useful of the four; for the noise he made had completely freed the house from the rats and mice with which it was before infested.—*Note by Goldsmith.*

[2] Buffon, vol. xv. p. 145.

[3] Many anecdotes have been told of the entire domestication of the mouse. A mouse taken out of a coal mine, near Newcastle, and placed under a glass case, evinced no natural apprehension of a cat that was produced to it.

[4] E volucribus hirundines sunt indociles, e terrestribus mures.—*Plin.*

[5] An extraordinary instance of the rapid increase of mice, and of the injury they sometimes do, occurred a few years ago in the new plantations, made by order of the crown, in the forest of Dean, Gloucestershire, and in the new forest, Hampshire. Soon after the formation of these plantations, a sudden and rapid increase of mice took place in them, which threatened destruction to the whole of the young plants. Vast numbers of these were killed,—the mice having eaten through the root of five years old oaks and chestnuts, generally just below the surface of the ground. Hollies also, which were five and six feet high, were barked round the bottom, and in some instances the mice had crawled up the tree, and were even feeding on the bark of the upper branches. In the reports made to government on the subject, it appears that the roots had been eaten through wherever they obstructed the run of the mice, but that the bark of the trees constituted their food. This was ascertained by confining a number of the mice in cages, and supplying them with the fresh roots and bark of trees, whence it was found that they fed greedily on the latter, and left the roots untouched. Various plans were devised for their destruction; traps were set, poison laid, and cats turned out, but nothing appeared to lessen their numbers. It was at last suggested, that if holes were dug into which the mice might be enticed or fall, their destruction might be effected. Holes, therefore, were made, about twenty yards asunder, in some of the Dean forest plantations, being about twelve in each acre of ground. These holes were from eighteen to twenty inches in depth, and two feet one way, and a half the other, and they were much wider at the bottom than the top, being

from whence most rain is expected; and from thence they often, on an evening, venture forth to drink the little drops either of rain or dew that hang at the extremities of the straw.[1] Aristotle gives us an idea of their prodigious fecundity, by assuring us, that having put a mouse with young into a vessel of corn, in some time after he found a hundred and twenty mice, all sprung from one original. The early growth of this animal implies also the short duration of its life, which seldom lasts above two or three years. This species is very much diffused, being found in almost all parts of the ancient continent, and having been exported to the new.[2] They are animals that, while they fear human society, closely attend it; and although enemies to man, are never found but near those places where he has fixed his habitation. Numberless ways have been found for destroying them; and Gesner has minutely described the variety of traps by which they are taken. Our Society for the Encouragement of Arts and Manufactures proposed a reward for the most ingenious contrivance for that purpose; and I observed almost every candidate passing off descriptions as inventions of his own. I thought it was cruel to detect the plagiarism or frustrate the humble ambition of those who would be thought the inventors of a mouse-trap.

To this species, merely to avoid teasing the reader with a minute description of animals very inconsiderable and very nearly alike,[3] I will add that of the LONG-TAILED FIELD-MOUSE, which is larger than the former, of a colour very nearly resembling the Norway rat, and chiefly found in fields and gardens. They are extremely voracious, and hurtful in gardens and young nurseries, where they are killed in great numbers. However, their fecundity quickly repairs the destruction.[4]

Nearly resembling the former, but larger, (for it is six inches long), is the SHORT-TAILED FIELD-MOUSE; which, as its name implies, has the tail much shorter than the former, it being not above an inch and a half long, and ending in a small tuft. Its colour is more inclining to that of the domestic mouse, the upper part being blackish, and the under of an ash colour. This, as well as the former, are remarkable for laying up provision against winter; and Mr Buffon assures us they sometimes have a store of above a bushel at a time.[5]

---

excavated hollow under, so that the animal, when once in, could not easily get out again. In these holes, at least 30,000 mice were caught in the course of three or four months, that number having been counted out and paid for by the proper officers of the forest. It was however calculated, that a much greater number of mice than these were taken out of the holes, after being caught, by stoats, weasels, kites, hawks, and owls, and also by crows, jays, and magpies. As the mice increased, so did the birds of prey, of which at last there were an incredible number. In new forest, from the weekly reports of the deputy surveyor of the forest, about the same number were destroyed, allowing the same calculation for those eaten by vermin: and in addition to which, it should be mentioned, that these mice were found to eat each other when their food fell short in winter. Putting these circumstances together, the total destruction of mice in the two forests, would probably amount to more than 200,000.—*Jesse's Gleanings.*

[1] Buffon, vol. xv. p. 147.

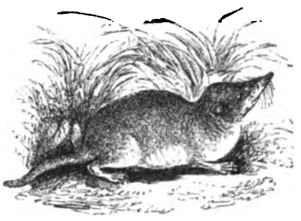
[2] Lisle's Husbandry, vol. ii. p. 391.

[3] *White Mice* with red eyes are not uncommon on the continent, while here they are so rare as to be exhibited as curiosities.

[4] *The Harvest Mouse.*—This is probably the smallest of British quadrupeds, the body not exceeding two inches and a quarter in length; the weight is said to be about one-sixth of an ounce. Mr White in his history of Selborne, says, "These mice are much smaller and more slender than the *Mus domesticus medius* of Ray, and have more of the squirrel or dormouse colour. They never enter into houses; are carried into ricks and barns with the sheaves; abound in harvest, and build their nest amidst the straws of corn above the ground, and sometimes in thistles. They breed as many as eight at a litter, in a little brown nest, composed of blades of grass and wheat. The nest is most artificially platted, perfectly round, and about the size of a cricket ball, with the aperture so ingeniously closed, that there is no discovering to which part it belongs. It is so compact and well fitted, that it will roll across a table without being discomposed, though it contained eight little mice, which are naked and blind. As the nest is perfectly full, how could the dam come at her litter respectively, so as to administer a teat to each? Perhaps she opens different places for that purpose, adjusting them again when the business is over; but she could not possibly be contained in the ball with her young, which moreover, would be daily increasing in bulk."

[5] *The Economic Campagnol.*—The length of this animal is about four inches, exclusive of the tail, which measures one inch. The limbs are strong; the ears short, naked, and almost hidden beneath the fur of the head.—The general colour is tawny, somewhat whiter beneath than on the back. Economic Campagnols are found in various parts of Siberia and Kamtschatka, where they make their burrows, with the utmost skill, immediately below the surface of a soft turfy soil. They form a chamber of a flattish arched form, about a foot in diameter, to which they sometimes add twenty or thirty small passages or entrances. Near the chamber they frequently construct other caverns, in which they deposit their stores or plants, which they gather in summer and bring home; and even at times they bring them out of their cells to give them a more thorough drying in the sun. They associate in pairs; and except during the summer, when the male leads a solitary life in the woods, the male and female commonly sleep in the same nest. The migrations of these quadrupeds have been noticed both by Dr Grieve and Mr Pennant; but neither of them have attempted to explain the cause. "In the spring," says the former writer, "they assemble in amazing numbers, and proceed in a direct course westward, swimming with the utmost intrepidity over rivers, lakes, and even arms of the sea. Many are drowned, and many are destroyed by water-fowl, or rapacious fish. Those that escape, on emerging from the water, rest awhile to bask, dry their fur, and refresh themselves. The Kamstchadales, who have a kind of

THE SHREW-MOUSE.



We may add also the SHREW-MOUSE to this species of minute animals, being about the size of the domestic mouse, but differing greatly from it in the form of its nose, which is very long and slender. The teeth also are of a very singular form, and twenty-eight in number; whereas the common number in the rat kind is usually not above sixteen. The two upper fore teeth are very sharp, and on each side of them there is a kind of wing or beard, like that of an arrow, scarcely visible but on a close inspection. The other teeth are placed close together, being very small, and seeming scarcely separated; so that with respect to this part of its formation, the animal has some resemblance to the viper. However, it is a very harmless little creature, doing scarcely any injury. On the contrary, as it lives chiefly in the fields, and feeds more upon insects than corn, it may be considered rather as a friend than an enemy. It has a strong, disagreeable smell, so that the cat, when it is killed, will refuse to eat it. It is said to bring forth four or five young at a time.

THE DORMOUSE.

These animals may be distinguished into three kinds; the GREATER DORMOUSE, which Mr Buffon calls the LOIR; the MIDDLE, which he calls the LEROT; the LESS, which he denominates the MUSCARDIN. They differ from each other in size, the largest being equal to a rat, the least being no bigger than a mouse. They all differ from the rat in having the tail tufted with hair, in the manner of a squirrel, except that the squirrel's tail is flat, resembling a fan, and theirs round, resembling a brush. The lerot differs from the loir by having two black spots near the eyes; the muscardin differs from both in the whitish colour of its hair on the back. They all three agree in having black sparkling eyes; and the whiskers partly white and partly black. They agree in their being stupified, like the marmout during the winter, and in their hoarding up provisions to serve them in case of a temporary revival.

They inhabit the woods or very thick hedges, forming their nests in the hollow of some tree, or near the bottom of a close shrub, humbly content with continuing at the bottom, and never aspiring to sport among the branches. Towards the approach of the cold season, they form a little magazine of nuts, beans, or acorns; and having laid in their hoard, shut themselves up with it for the winter. As soon as they feel the first advances of the cold, they prepare to lessen its effect by rolling themselves up in a ball, and thus exposing the smallest surface to the weather. But it often happens that the warmth of a sunny day, or an accidental change from cold to heat, thaws their nearly stagnant fluids, and they revive. On such occasions they have their provisions laid in, and they have not far to seek for their support. In this manner they continue usually asleep, but sometimes waking, for about five months in the year, seldom venturing from their retreats, and, consequently, but rarely seen. Their nests are lined with moss, grass, and dead leaves; they usually bring forth three or four young at a time, and that but once a year, in the spring.

THE MUSK RAT.

Of these animals of the rat kind, but with

---

superstitious veneration for these little animals, whenever they find any of them on the banks of the rivers, weak and exhausted, render them every possible assistance. As soon as they have crossed the river Penschinska, at the head of the gulf of the same name, they turn in a south-westerly direction; and about the middle of July, generally reach the rivers Ochetska and Judoma, a distance of about a thousand miles! The flocks are also so numerous, that travellers have waited about two hours for them to pass. The retirement of these animals is considered by the Kamtschadales a misfortune; but their return occasions joy and festivity, a successful chase and fishery being considered as its certain consequence." Kerr informs us, that if the Kamtschadales take away part of the hoard of these rats, they invariably leave some caviare, or other food, to support them in its stead. The manner in which the economic campagnols cross the rivers of Iceland, is thus described by Mr Olaffen:—"The party, consisting of from six to ten, select a flat piece of dried cow-dung, on which they place the berries they have collected in a heap on the middle. Then, with their united force, drawing it to the water's edge, they launch it, and embark; placing themselves round the heap, with their heads joined over it, and their backs to the water, their tails pendent in the stream serving the purpose of rudders."

a musky smell, there are also three distinctions, as of the former; the ONDATRA, the DESMAN, and the PILORI. The ondatra is a native of Canada, the desman of Lapland, and the pilori of the West India Islands. The ondatra differs from all others of its kind, in having the tail flatted and carried edge-ways. The desman has a long extended snout, like the shrew-mouse; and the pilori a short tail, as thick at one end as the other. They all resemble each other in being fond of the water, but particularly in that musky odour from whence they have taken their name.

Of these the ONDATRA is the most remarkable, and has been the most minutely described.[1] This animal is about the size of a small rabbit, but has the hair, the colour, and the tail of a rat, except that it is flatted on the sides, as mentioned above. But it is still more extraordinary upon other accounts, and different from all other animals whatever. It is so formed that it can contract and enlarge its body at pleasure. It has a muscle like that of horses, by which they move their hides, lying immediately under the skin, and that furnished with such a power of contraction, together with such an elasticity in the false ribs, that this animal can creep into a hole where others, seemingly much less, cannot follow. The female is remarkable also for two distinct apertures, one for urine, the other for propagation. The male is equally observable for a peculiarity of conformation; the musky smell is much stronger at one particular season of the year than any other; and the marks of the sex seem to appear and disappear in the same manner.

The ondatra in some measure resembles the beaver in its nature and disposition. They both live in society during winter; they both form houses of two feet and a half wide, in which they reside several families together. In these they do not assemble to sleep as the marmout, but purely to shelter themselves from the rigour of the season. However, they do not lay up magazines of provision like the beaver; they only form a kind of covert-way to and round their dwelling, from whence they issue to procure water and roots, upon which they subsist. During winter their houses are covered under a depth of eight or ten feet of snow; so that they must lead out a cold, gloomy, and necessitous life, during its continuance. During summer they separate two by two, and feed upon the variety of roots and vegetables that the season offers. They then become extremely fat, and are much sought after, as well for their flesh as their skins, which are very valuable. They then also acquire a very strong scent of musk so pleasing to an European, but which the savages of Canada cannot abide. What we admire as a perfume, they consider as a most abominable stench, and call one of their rivers, on the banks of which this animal is seen to burrow in numbers, by the name of the *stinking river*, as well as the rat itself, which is denominated by them the *stinkard*. This is a strange diversity among mankind; and, perhaps, may be ascribed to the different kinds of food among different nations. Such as chiefly feed upon rancid oils, and putrid flesh, will often mistake the nature of scents; and, having been long used to ill smells, will, by habit, consider them as perfumes. Be this as it will, although these nations of northern savages consider the musk rat as intolerably fœtid, they nevertheless regard it as very good eating, and, indeed, in this they imitate the epicures of Europe very exactly, whose taste seldom relishes a dish till the nose gives the strongest marks of disapprobation. As to the rest, this animal a good deal resembles the beaver in its habits and disposition; but, as its instincts are less powerful, and its economy less exact, I will reserve for the description of that animal a part of what may be applicable to this.

THE CRICETUS.

The Cricetus, or German rat, which Mr Buffon calls the *hamster*, greatly resembles the water-rat in its size, small eyes, and the shortness of its tail. It differs in colour, being rather browner, like the Norway rat, with the belly and legs of a dirty yellow. But the marks by which it may be distinguished from all others are two pouches, like those of a baboon, on each side of its jaw, under the skin, into which it can cram a large quantity of provision. These bags are oblong, and of the size, when filled, of a large walnut. They open into the mouth, and fall back along the neck to the shoulder. Into these the animal can thrust the surplus of those fruits or grains it gathers in the fields, such as wheat, peas, or acorns. When the immediate calls of hunger are satisfied, it then falls to filling these; and thus loaded with two great bunches on each side of the jaw, it returns home to its hole to deposit the spoil as a store for the winter. The size, the fecundity, and the voraciousness of this animal, render it one of the greatest pests in the countries where it is found, and every method is made use of to destroy it.[2]

---

[1] Buffon, vol. xx. p. 4.

[2] Among animals of this kind, which are furnished with pouches on each side of the mouth, the most remarkable is the Canada rat. Its size is that of the Norway

But although this animal is very noxious with respect to man, yet, considered with regard to those instincts which conduce to its own support and convenience, it deserves our admiration.[1] Its hole offers a very curious object for contemplation. and shows a degree of skill superior to the rest of the rat kind. It consists of a variety of apartments, fitted up

---

rat, though of a more lengthened form. Its colour is a pale grayish-brown, paler beneath. The pouches attached to the cheeks are of a very large size, shaped somewhat like an egg, reach to the ground, and have the appearance of a pair of inflated bladders.

The *Anomalous Hamster*. found in the Isle of Trinity, is about the size of the common rat, but the nose is more pointed; the ears are naked, round, and of moderate size: the pouches are formed by a duplicature of the common tegument, like the pouch of the opossum, and are of considerable size. The body is covered with fine lance-shaped spines, stronger on the back than elsewhere, intermixed with hair. This species differs perhaps generically from the other hamsters, with which, indeed, it seems to have no other relationship than by the cheek-pouches.

The genus *Jerboa* approximates considerably to the rats properly so called, by a great number of characters of internal organization, but is sufficiently distinguished by the shortness of the anterior limbs, and the length of the hinder extremities, or to speak more correctly, of the hinder metatarsi, and by the tail, which is covered with long hairs at its extremities. As to external conformation, the jerboas exhibit some relations with the kanguroos. The form of the body is the same in general. The hinder limbs are likewise five or six times stronger than the fore. In both genera the tail is very long; the ears elongated, and pointed, and the eyes very large and round. But though the kanguroos have so many treats of external conformation similar to the jerboas, they are infinitely removed from them in most important points, such as the organs of generation, ventral pouch, &c. The jerboas have the same teeth as the rats, that is, they have two incisors in each jaw; and the lower, instead of being flat and cut scissors-like, as the upper, on the contrary, are conic and pointed. The molars are generally six in number, three on each side. They are slightly sloped. There is sometimes an additional one in the upper jaw. In the jerboas the cheek-bones are very prominent, which gives a singular and flatted form to the front part of the head. The muzzle is short, large, and obtuse. A considerable number of stiff hairs extend on each side, and form long mustachios. The nose is naked, cartilaginous, and in one species rather complicated. The ears are long and pointed; the eyes large, and placed altogether on the sides of the head. The body is a little elongated, larger behind than before, and well covered with soft and silken hairs. The fore-feet are very short and feeble. They have four or five toes according to the species. The thumb or interior toe, where it exists, is very short, rounded at its extremity, and provided with an obtuse nail. The other toes are long and armed with crooked nails. The hind-feet are as disproportioned as those of the kanguroos, being four or five times longer than the fore-feet. They are terminated by five or six toes, according to the species, which are armed with short, but large and obtuse claws.

Ancient and modern naturalists have both been mistaken respecting the walk of the jerboa. They have all imagined that these quadrupeds walked on their hind feet only, never employing the fore-feet for that purpose. From this error the genus was named *dipus*, two legged. It usually walks on its four feet; but when frightened from any cause, it endeavours to escape by means of prodigious leaps, which it executes with equal force and activity. When these animals are about to leap, they raise their body upon the extremity of their hind toes, and support themselves upon their tail. Their fore feet are so closely attached to their breast, that they are scarcely visible. Having taken their spring, they leap, and fall upon their four feet; then they elevate themselves again with so much celerity, that it almost appears that they are constantly in an erect posture.

The genus jerboa is now composed of several distinct species, one of which is extremely abundant in Barbary. in Higher and Lower Egypt, and Syria, and again in the more northern climates, situated between the Tanais and the Volga. The others occupy an immense space in Siberia and the north part of Russia, from Syria to the Eastern Ocean, and as far as the northern parts of Hindostan. A late one, recently described by M. de Blainville, has been published, though it would seem erroneously, as belonging to New Holland.

The jerboa is very timid, and retires on the least alarm to its burrow. It lives in troops, which make their retreats in the sand, often burrowing to a considerable extent, but seldom to any great depth; and around the entrance of these they are often seen sitting or playing, or engaged in search of food. The north of Africa, Egypt, and Syria are the countries in which this species is indigenous. Among those who have observed its manners in a state of freedom we may notice Sonnini. "The jerboa," he says, "appears to be a prolific animal, for it is exceedingly numerous in Arabia, Nubia, Egypt, and Barbary. During my stay, or rather my excursions, in Egypt, I opened several jerboas: my principal aim was to ascertain that they had only one stomach, and consequently could not possess the power of ruminating. This was in answer to one of the questions that Michaelis, professor at Göttingen, had addressed to the travellers sent to the East by the king of Denmark—viz., whether the jerboa was a ruminating animal?—a question arising from the mistake which had occasioned the confounding the jerboa with the *Daman Israel*, or *Saphan* of the Hebrews. The sand and ruins that surround modern Alexandria are much frequented by the jerboas. They live in society, and in burrows, which they dig with their teeth and nails. I have even been told that they sometimes make their way through the soft stone which is under the stratum of sand. Though not absolutely wild, they are very shy; and upon the least noise, or the sight of any object, retire precipitately to their holes. They can only be killed by surprise. The Arabs contrive to take them alive by stopping up all the avenues to their burrows, except one, by which they force them to come out. I never ate any: their flesh indeed, is said not to be very palatable, though it is not despised by the Egyptians. Their skin, covered with soft and shining hair, is used as a common fur. In Egypt, I kept six of these animals, for some time, in a large iron cage; the very first night they entirely gnawed through the upright and cross pieces of wood, and I was obliged to have the inside of the cage lined with tin. They ate rice, walnuts, and all kinds of fruit. They delighted in being in the sun. Although they have a great deal of agility in their motions, they seem to be of a mild and tranquil disposition: mine suffered themselves to be touched without difficulty; and there was neither noise nor quarrel among them, even when taking their food. At the same time they testified neither joy, fear, nor gratitude; their gentleness was neither amiable nor interesting: it appeared to be the effect of cold and complete indifference, bordering on stupidity. Three of these animals died successively before my departure from Alexandria. I lost two others during a somewhat stormy passage to for the different occasions of the little inhabitant. It is generally made on an inclining ground, and always has two entrances, one perpendicular, and the other oblique; though, if there be more than one in a family, there are as many perpendicular holes as there are individuals below. The perpendicular hole is usually that through which they go in and out: the oblique serves to give a thorough air to keep the retreat clean, and in case one hole is stopped, to give an exit at this. Within about a foot of the perpendicular hole, the animal makes two more, where are deposited the family's provisions. These are much more spacious than the former, and are large in proportion to the quantity of the store. Beside these, there is still another apartment warmly lined with grass and straw, where the female brings forth her young; all these communicate with each other, and all together take up a space of ten or twelve feet in diameter. These animals furnish their store-houses with dry corn, well cleaned; they also lay in corn in the ear, and beans and peas in the pod. These, when occasion requires, they afterwards separate, carrying out the pods and empty ears by their oblique passage. They usually begin to lay in at the latter end of August; and, as each magazine is filled, they carefully cover up the mouth with earth, and that so neatly that it is no easy matter to discover where the earth has been removed. The only means of finding out their retreats are, therefore, to observe the oblique entrance, which generally has a small quantity of earth before it; and this, though often several yards from their perpendicular retreat, leads those who are skilled in the search to make the discovery. Many German peasants are known to make a livelihood by finding out and bringing off their hoards, which, in a fruitful season, often furnish two bushels of good grain in each apartment.

---

[1] Buffon, vol. xxvi. p. 159.

Like most others of the rat kind, they produce twice or thrice a year, and bring five or six at a time. Some years they appear in alarming numbers, at other times they are not so plentiful. The moist seasons assist their propagation; and it often happens on such years that their devastations produce a famine all over the country. Happily, however, for mankind, these, like the rest of their kind, destroy each other; and of two that Mr Buffon kept in a cage, male and female, the latter killed and devoured the former. As to the rest, their fur is considered as very valuable; the natives are invited by rewards to destroy them; and the weasel kind seconds the wishes of government with great success. Although they are usually found brown on the back and white on the belly, yet many of them are observed to be gray; which may probably arise from the difference of age.

THE LEMING.

Having considered various kinds of these noxious little animals that elude the indignation of mankind, and subsist by their number, not their strength, we come to a species more bold, more dangerous, and more numerous than any of the former. The leming, which is a native of Scandinavia, is often seen to pour down in myriads from the northern mountains, and, like a pestilence, destroy all the productions of the earth. It is described as being larger than a dormouse, with a bushy tail, though shorter. It is covered with thin hair of various colours. The extremity of the upper part of the head is black, as are likewise the neck and shoulders, but the rest of the body is reddish, intermixed with small black spots of various figures, as far as the tail, which is not above half an inch long. The eyes are little and black, the ears round and inclining towards the back, the legs before are short, and those behind longer, which gives it a great degree of swiftness. But what it is much more remarkable for than its figure, are, its amazing fecundity and extraordinary migrations.

In wet seasons, all of the rat kind are known to propagate more than in dry; but this species in particular is so assisted in multiplying by the moisture of the weather, that the inhabitants of Lapland sincerely believe that they drop from the clouds, and that the same magazines that furnish hail and snow pour down the leming also upon them. In fact, after long rain, these animals set forward from their native mountains, and several millions in a troop deluge the whole plain with their numbers.[1] They move, for the most part, in a square, marching forward by night, and lying still by day. Thus, like an animated torrent, they are often seen more than a mile broad covering the ground, and that so thick that the hindmost touches its leader. It is in vain that the poor inhabitant resists or attempts to stop their progress, they still keep moving forward, and though thousands are destroyed, myriads are seen to succeed, and make their destruction impracticable. They generally move in lines, which are about three feet from each other, and exactly parallel. Their march is always directed from the north-west to the south-east, and regularly conducted from the beginning. Wherever their motions

---

the Isle of Rhodes, when the last, owing to the negligence of the person to whose care it was committed, got out of its cage and disappeared."

[1] Phil. Trans. vol. ii. p. 872.

are turned, nothing can stop them; they go directly forward, impelled by some strange power; and, from the time they first set out, they never once think of retreating. If a lake or a river happens to interrupt their progress, they all together take the water and swim over it; a fire, a deep well, or a torrent does not turn them out of their straight lined direction; they boldly plunge into the flames, or leap down the well, and are sometimes seen climbing up on the other side. If they are interrupted by a boat across a river while they are swimming, they never attempt to swim round it, but mount directly up its sides; and the boatmen, who know how vain resistance in such a case would be, calmly suffer the living torrent to pass over, which it does without further damage. If they meet with a stack of hay or corn that interrupts their passage, instead of going over it, they gnaw their way through; if they are stopped by a house in their course, if they cannot get through it, they continue there till they die. It is happy, however, for mankind, that they eat nothing that is prepared for human subsistence; they never enter a house to destroy the provisions, but are contented with eating every root and vegetable that they meet. If they happen to pass through a meadow, they destroy it in a very short time, and give it an appearance of being burned up and strewed with ashes. If they are interrupted in their course, and a man should imprudently venture to attack one of them, the little animal is no way intimidated by the disparity of strength, but furiously flies up at its opponent, and barking somewhat like a puppy, wherever it fastens does not easily quit the hold. If at last the leader be forced out of its line, which it defends as long as it can, and separated from the rest of its kind, it sets up a plaintive cry, different from that of anger, and, as some pretend to say, gives itself a voluntary death, by hanging itself on the fork of a tree.

An enemy so numerous and destructive would quickly render the countries where they appear utterly uninhabitable, did it not fortunately happen, that the same rapacity that animates them to destroy the labours of mankind, at last impels them to destroy and devour each other.[1] After committing incredible devastations, they are at last seen to separate into two armies, opposed with deadly hatred, along the coast of the larger lakes and rivers. The Laplanders, who observe them thus drawn up to fight, instead of considering their mutual animosities as a happy riddance of the most dreadful pest, form ominous prognostics from the manner of their arrangement. They consider their combats as a presage of war, and expect an invasion from the Russians or the Swedes, as the sides next those kingdoms happen to conquer. The two divisions, however, continue their engagements and animosity until one party overcomes the other. From that time they utterly disappear, nor is it well known what becomes of either the conquerors or the conquered. Some suppose that they rush headlong into the sea; others, that they kill themselves, as some are found hanging on the forked branches of a tree; and others still, that they are destroyed by the young spring herbage. But the most probable opinion is, that, having devoured the vegetable productions of the country, and having nothing more to subsist on, they then fall to devouring each other; and, having habituated themselves to that kind of food, continue it. However this be, they are often found dead by thousands, and their carcases have been known to infect the air for several miles round, so as to produce very malignant disorders. They seem also to infect the plants they have gnawed, for the cattle often die that afterwards feed in the places where they passed.

As to the rest, the male is larger and more beautifully spotted than the female. They are extremely prolific; and, what is extraordinary, their breeding does not hinder their march; for some of them have been observed to carry one young one in their mouth, and another on their back. They are greatly preyed upon by the ermine, and, as we are told, even by the rein-deer. The Swedes and Norwegians, who live by husbandry, consider an invasion from these vermin as a terrible visitation; but it is very different with respect to the Laplanders, who lead a vagrant life, and who, like the lemings themselves, if their provisions be destroyed in one part of the country, can easily retire to another. These are never so happy as when an army of lemings comes down amongst them; for then they feast upon their flesh; which, though horrid food, and which, though even dogs and cats are known to detest, these little savages esteem very good eating, and devour greedily. They are glad of their arrival also upon another account, for they always expect a great plenty of game the year following, among those fields which the lemings have destroyed.

THE MOLE.

To these minute animals of the rat kind, a great part of whose lives is passed in holes under ground, I will subjoin one little animal more, no way resembling the rat, except that its whole life is spent there. As we have seen some quadrupeds formed to crop the surface of the fields, and others to live upon the tops of trees, so the mole is formed to live wholly under the earth, as if nature meant that no place should be left wholly untenanted.

---

[1] Dictionnaire Raisonnée, vol. ii. p. 610.

[2] Moles (see Plate XII. fig. 23) are very savage in their nature, and will attack animals much larger than themselves. An experiment was tried to ascertain the courage of one, by confining it in a glass case, along

---

with a viper and a toad; the mole killed both, and devoured part of each.

Mr Arthur Bruce records, in the Linnæan Transactions, a circumstance which appears to have been before unknown—that of the mole being addicted to swimming. We shall give the account in his own words:—"On visiting the loch of Clunie, which I often did, I observed in it a small island at the distance of one hundred and eighty yards from the nearest land, measured upon the ice. Upon the island, the Earl of Airlie, the proprietor, had a small castle and shrubbery. I remarked frequently the appearance of fresh mole-casts, or hills. I for some time took them for those of the water mouse, and one day asked the gardener if it was so. 'No,' he said; 'it was the mole; and that he had caught one or two lately.' Five or six years ago, he caught two in traps, and for two years after this he had observed none. But, about four years ago, coming ashore one summer's evening in the dusk, he and the Earl of Airlie's butler, they saw at a short distance upon the smooth water some animal paddling towards the island! They soon closed with this feeble passenger, and found it to be the common mole, led by a most astonishing instinct from the castle hill, the nearest point of land, to take possession of this desert island. It had been at the time of my visit, for the space of two years, quite free from any subterraneous inhabitant; but the mole has for more than a year past, made its appearance again, and its operations I have since been witness to."

In the Magazine of Natural History, Mr H. Turner mentions a circumstance similar to the above account: he says, "Last summer and autumn (1831) I visited a river at the bottom of the Botanic Garden of Bury St Edmund's, several times very early in the morning, and late in the evening, for the purpose of procuring a specimen of the kingfisher, to preserve, which is frequently to be met with here. One morning, as I sat very quietly, I observed a mole come out of an osier holt and run across a grass path, and take to the water: when it was about half across the river, I ran to the edge of the water, and the mole then made a perceptible attempt to dive, but merely immersed his nose in the water for half a minute, and rapidly gained the shore, and soon disappeared in a hole of the bank. A few mornings afterwards I saw it take to the water as before, but as I remained perfectly still, I observed its unrestrained actions. It was nearly four minutes in swimming six yards, and appeared as if it rather enjoyed its morning's bathing. I mentioned this to an old mole-catcher, as I thought it rather singular, who replied, 'I've seen 'em swim across rivers of a devil and all of width.'"

The mole shows changes of weather. The temperature or dryness of the air governs its motions as to the depth at which it lives or works. This is partly from its inability to bear cold or thirst, but chiefly from the necessity of following its natural and ordinary food, the common earth-worm, which always descends as the cold or drought increases. In frosty weather, both worms and moles are deeper in the ground than at other times, and both seem to be sensible of an approaching change to warmer weather, before there are any perceptible signs of it in the atmosphere. When it is observed, therefore, that moles are casting hills through openings in the frozen turf, or through a thin covering of snow, a change to open weather may be shortly expected. The cause of this appears to be: the natural heat of the earth, being for a time pent in by the frozen surface, accumulates below it: first incites to action the animals, thaws the frozen surface, and at length escapes into the open air, which it warms and softens, and, if not counterbalanced by a greater degree of cold in the atmosphere, brings about a change. Changes from frosty to mild weather, caused by the ascent of heat from the earth, are often so evident, that the circumstance needs no confirmation. Stronger proof, if proof were necessary, cannot be given than the common appearance of frost or snow remaining longer upon ground having a stratum of rock beneath, than upon that where there is none.

The mole is frequently of much more use to the agriculturist than he imagines, as it drains his lands by natural means, and destroys worms. Mr James Hogg, the Ettrick Shepherd, makes the following remarks on this subject:—"The most unnatural of all persecutions that ever was raised in a country, is that against the mole—that innocent and blessed little pioneer, who enriches our pastures annually with the first top-dressing, dug with great pains and labour from the fattest of the soil beneath. The advantages of this top-dressing are so apparent, and so manifest to the eye of every unprejudiced person, that it is really amazing how our countrymen should have persisted, now nearly half a century, in the most manly and valiant endeavours to exterminate the moles from the face of the earth. If a hundred men and horses were employed on a common-sized pasture farm, say from fifteen hundred to two thousand acres, in raising and conveying manure for a top-dressing of that farm, they would not do it so effectually, so neatly, or so equally, as the natural number of moles on that farm would do themselves."

Little was known of the natural history of this animal, (says Mr Jesse, in his Gleanings in Natural History,) till a French naturalist, M. St Hilaire, published lately some interesting particulars respecting it. The mole forms several under-ground passages, and the way she proceeds in doing this is as follows:—She first makes a *run* in various directions, by undermining the ground, and unites this and several others at one point, making, however, some of them larger than the others. M. St Hilaire says that she finishes by arranging them with the most perfect symmetry, plastering the sides with great care, and when completed, it may be called her *encampment*. In the centre of these works she establishes herself, and appropriates a separate place to the reception of her young, which is in some respects differently constructed from her own. In order to render the respective habitations which she and her young occupy not liable to be injured by the rain, she makes them almost even with the ground, and higher up than the runs, which serve as drains, or channels, to carry off the water. She makes choice of the place of her abode with the greatest care, sometimes constructing it at the foot of a wall, or near a hedge or a tree, where it has the less chance of being broken in. This abode is sometimes protected by having a quantity of earth thrown over it, especially in light soils, where I have seen a mound almost large enough to fill a weeelbarrow. Sometimes, however, no earth is thrown up over the habitation.

Were we from our own sensations to pronounce upon the life of a quadruped that was never to appear above ground, but always condemned to hunt for its prey underneath, obliged, whenever it removed from one place to another, to bore its way through a resisting body, we should be apt to assert that such an existence must be the most frightful and solitary in nature. However, in the present animal, though we find it condemned to all those seeming inconveniences, we shall discover no signs of wretchedness or distress. No quadruped is fatter, none has a more sleek or glossy skin; and, though denied many advantages that most animals enjoy, it is more liberally possessed of others, which they have in a more scanty proportion.

This animal, so well known in England, is, however, utterly a stranger in other places, and particularly in Ireland. For such, there-

---

This precaution of the mole is very necessary, to prevent the places she has chosen for retreats for herself and her young from being trampled in. When a mole has occasion to make her run through a gateway, I have observed that she generally carries it as near as possible to the gate-post, where it is less likely to be injured. Some runs are so near the surface, that I have seen the ground crack during the animal's progress in working them. The bed for the young is composed of the blades of wheat, with which the mole forms a sort of matress. Four hundred and two of them were counted in one nest, and all so fresh in their appearance, that they had been probably collected by this little animal in the course of two or three days. This shows not only her extraordinary industry, but the great depredations she must commit.

The mole is never known to work for food near the place which she has fixed upon for her abode. She labours to procure it about two hours in the morning, and as many in the evening, and then returns to her home or resting-place, which is so constructed that she is instantly made aware of any danger. This effect is produced by forming the upper runs in a sort of circle, so as to communicate a vibration when any thing passes over them. The mole then takes alarm, and escapes by one of her *safety* runs.

The mole is not often seen on the surface of the earth. I once, however, caught one, and turned it loose upon a lawn, the turf of which was on a bed of strong gravel, and particularly hard and dry. Notwithstanding these disadvantages, the mole contrived to bury itself almost in an instant, working into the earth by means of her snout and fins (for they can hardly be called feet), so fast that the ground seemed to yield to her mere pressure.

The power of smelling in the mole is very acute; and it is supposed that this sense serves to direct her in the search of her food. She hunts after beetles and worms, which last she pursues eagerly, but not always successfully; for the earthworm is aware of its danger, and quick in escaping from it. Her search for prey taking place in the morning and evening, when birds are more generally on their feed, must be the means of contributing greatly to their subsistence by driving worms to the surface of the earth, and furnishes another striking proof that the "fowls of the air" have their food provided by an Almighty and superintending Providence in a variety of ways.

Le Court, who assisted M. St Hilaire in his observations, and who appears to have been a sort of philosophical mole-catcher, was surprised when the naturalist expressed a doubt as to the mole seeing. He informed him that, in swimming rivers, they habitually guide themselves by their sight: but in order to satisfy M. St Hilaire on this point, he contrived the following experiment with him:—They made two openings in a dry tiled drain, at one of which several moles were successively introduced. Le Court took his stand at the other. If he stood quite still, the mole soon came out and escaped; but if, at the moment in which she showed herself at the hole, he moved only his thumb, she stopped and turned back. By repeating this as often as she re-appeared, the mole was kept imprisoned in the drain.

There has been a very general idea amongst our mole-catchers, that if the smallest drop of blood is taken from a mole, it occasions instant death. Le Court seems to account for this opinion in speaking of the fights which take place between the male moles, by saying, that if one is ever so slightly wounded in a vein near the ear, the wound is mortal.

In order to ascertain the rate at which a mole moved, he put in practice the following curious experiment:—He placed some slight sticks, with a little flag at the top of them, in the run of a mole, which he had previously ascertained, by tracing it, to be of considerable length, and along which the mole passed and repassed four times a-day in search of food. These sticks were placed at certain intervals in the run, so that if the mole touched them, the flag would instantly show it. He then introduced a horn at one extremity of the run, and blowing it loudly, frightened the animal; and she then went along the run at such a rate, moving the flags in her passage, that Le Court and his friends, who were stationed at intervals along the run to assist in the observation, considered that she went as fast as a horse could trot at its greatest speed.

Hunger in the mole is thought to be a more violent feeling than fear, and its appetite is singularly voracious. If it sees a bird near, it quits its hole—approaches as if to attack it; and if the bird pecks it, the mole retires towards its hole, and tempts the bird to follow. She then watches her opportunity—darts upon it—seizes it by the belly, which she tears open, assisting herself for this purpose with her *flaps*, and, thrusting her head into it, devours it. She drinks as greedily as she eats. The mole does not, like the mouse, lay up a store of food, as she preys on worms and various kinds of insects; she will also eat frogs, but will not touch a toad, if ever so hungry. A mole was tried with eggs and oysters, but refused to eat either. They will, however, eat fruit, and, Buffon says, acorns. If two moles are shut up together without food, the stronger will devour the weaker, even to the bones: nothing but the skin is left, which they never eat, and which, when one has killed the other, is always seen to be ripped up along the belly. It was found that ten or twelve hours was the longest time they could live without food. This fact seems to prove that the mole is not torpid in frosty weather, which Linnæus asserted she was. It is known that, in such seasons, worms, ants, and the larvæ of cockchaffers and beetles, penetrate deep into the ground. It is probable, therefore, that the runs of the mole made in search of food are regulated, as to their depth, by the habits of the grubs on which she feeds. One would suppose, from the texture of its fur, which is particularly short and thick, that the mole is not very susceptible of cold. Indeed, its whole formation is admirably adapted to its mode of life.

It has been said that the mole, when the ground which it frequents is flooded, will climb up trees. This, however, seems to be unnecessary, as I have seen it swim with perfect ease, which indeed Le Court had also observed.

fore, as have never seen it a short description will be necessary. And, in the first place, though somewhat of a size between the rat and the mouse, it no way resembles either, being an animal entirely of a singular kind, and perfectly unlike any other quadruped whatever. It is bigger than a mouse, with a coat of fine, short, glossy, black hair. Its nose is long and pointed, resembling that of a hog, but much longer. Its eyes are so small, that it is scarcely possible to discern them. Instead of ears, it has only holes in the place. Its neck is so short that the head seems stuck upon the shoulders. The body is thick and round, terminating by a very small short tail; and its legs also are so very short, that the animal seems to lie flat on its belly. From under its belly, as it rests in this position, the four feet appear just as if they immediately grew out of the body. Thus the animal appears to us at first view as a mass of flesh covered with a fine, shining, black skin, with a little head, and scarcely any legs, eyes, or tail. On a closer inspection, however, two little black points may be discerned, that are its eyes. The ancients, and some of the moderns, were of opinion that the animal was utterly blind; but Derham, by the help of a microscope, plainly discovered all the parts of the eye that are known in other animals, as the pupil, the vitreous and crystalline humours. The fore-legs appear very short and strong, and furnished with five claws to each. These are turned outwards and backwards, as the hands of a man when swimming. The hind-legs are longer and weaker than the fore, being only used to assist its motions; whereas the others are continually employed in digging. The teeth are like those of a shrew-mouse, and there are five on both sides of the upper jaw, which stand out; but those behind are divided into points. The tongue is as large as the mouth will hold.

Such is the extraordinary figure and formation of this animal, which, if we compare with its manner of living, we shall find a manifest attention in nature to adapt the one to the other.[1] As it is allotted a subterraneous abode, the seeming defects of its formation vanish, or rather are turned to its advantage. The breadth, strength, and shortness of the fore-feet, which are inclined outwards, answer the purposes of digging, serving to throw back the earth with greater ease, and to pursue the worms and insects which are its prey: had they been longer, the falling in of the earth would have prevented the quick repetition of its strokes in working; or have obliged it to make a larger hole in order to give room for their exertion. The form of the body is not less admirably contrived for its way of life. The fore-part is thick, and very muscular, giving great strength to the action of the fore-feet, enabling it to dig its way with amazing force and rapidity either to pursue its prey, or elude the search of the most active enemy. By its power of boring the earth, it quickly gets below the surface; and I have seen it, when let loose in the midst of a field, like the ghost on a theatre, instantly sink into the earth; and the most active labourer, with a spade in vain attempted to pursue.

The smallness of its eyes, which induced the ancients to think it was blind,[2] is, to this animal, a peculiar advantage. A small degree of vision is sufficient for a creature that is ever destined to live in darkness. A more extensive sight would only have served to show the horrors of its prison, while nature had denied it the means of an escape. Had this organ been larger, it would have been perpetually liable to injuries, by the falling of the earth into it; but nature, to prevent that inconvenience, has not only made them very small, but very closely covered them with hair. Anatomists mention, besides these advantages, another that contributes to their security; namely, a certain muscle, by which the animal can draw back the eye whenever it is necessary or in danger.

As the eye is thus perfectly fitted to the animal's situation, so also are the senses of hearing and smelling. The first gives it notice of the most distant appearance of danger; the other directs it, in the midst of darkness, to its food. The wants of a subterraneous animal can be but few; and these are sufficient to supply them: to eat, and to produce its kind, are the whole employment of such a life; and for both these purposes it is wonderfully adapted by nature.[3]

Thus admirably is this animal fitted for a life of darkness and solitude; with no appetites but what it can easily indulge, with no enemies but what it can easily evade or conquer. As soon as it has once buried itself in the earth, it seldom stirs out unless forced by voilent rains in summer; or, when in pursuit of its prey, it happens to come too near the surface, and thus gets into the open air, which may be considered as its unnatural element. In general, it chooses the looser, softer grounds, beneath which it can travel with greater ease: in such also it generally finds the greatest number of worms and insects, upon which it chiefly preys. It is observed to be most active, and to cast up most earth, immediately before rain; and, in winter, before a thaw; at those times the worms and insects begin to be in motion, and approach the surface, whither this industrious animal pursues them. On the contrary, in very dry weather, the mole seldom or never forms any hillocks; for then it is obliged to penetrate deeper after its prey, which at such seasons retire far into the ground

---

[1] British Zoology.

[2] The ancients referred to the *spalax*, not our mole See a succeeding note.

[3] Testes habet maximos, parastatas amplissimas, novum corpus seminale ab his diversum ac separatum. Penem etiam facile omnium, ni fallor, animalium longissimum, ex quibus colligere est maximam præ reliquis omnibus animalibus voluptatem in coitu, hoc abjectum et vile animalculum percipere, ut habeant quod ipsi invideant qui in hoc supremas vitæ suæ delicias collocant: Ray's Synops. Quadrup. p. 239. Huic opinioni assentitur D. Buffon, attamen non mihi apparet magnitudinem partium, talem voluptatem augere. Maribus enim salacissimis contrarium obtinet.—*Goldsmith.*

As the moles very seldom come above ground, they have but few enemies; and very readily evade the pursuit of animals stronger and swifter than themselves.[1] Their greatest calamity is an inundation; which, wherever it happens, they are seen in numbers attempting to save themselves by swimming, and using every effort to reach the higher grounds. The greatest part, however, perish, as well as their young, which remain in the holes behind. Were it not for such accidents, from their great fecundity, they would become extremely troublesome; and, as it is, in some places, they are considered by the farmer as his greatest pest. They couple towards the approach of spring; and their young are found about the beginning of May. They generally have four or five at a time; and it is easy to distinguish among other mole-hills, that in which the female has brought forth her young. These are made with much greater art than the rest, and are usually larger. The female, in order to form this retreat, begins by erecting the earth into a tolerably spacious apartment, which is supported within by partitions, at proper distances, that prevent the roof from falling. All round this she works and beats the earth very firm, so as to make it capable of keeping out the rain, let it be ever so violent, As the hillock, in which this apartment is thus formed, is raised above ground, the apartment itself is consequently above the level of the plain, and, therefore, less subject to accidental slight inundations. The place being thus fitted, she then procures grass and dry leaves as a bed for her young. There they lie secure from wet, and she continues to make their retreat equally so from danger; for all round this hill of her own raising, are holes running into the earth, that part from the middle apartment, like rays from a centre, and extend about fifteen feet in every direction; these resemble so many walks or chases, into which the animal makes her subterraneous excursions, and supplies her young with such roots or insects as she can provide: but they contribute still more to the general safety; for as the mole is very quick of hearing, the instant she perceives her little habitation attacked, she takes to her burrow, and unless the earth be dug away by several men at once, she and her young always make good a retreat.

The mole is scarcely found, except in cultivated countries: the varieties are but few.[2] That which is found in Virginia, resembles the common mole, except in colour, which is black, mixed with a deep purple. There are sometimes white moles, seen particularly in Poland, rather larger than the former. As their skin is so very soft and beautiful, it is odd that it has not been turned to any advantage. Agricola tells us, that he saw hats made from it, the finest and the most beautiful that could be imagined.[3]

---

[1] Buffon.

[2] The shrew-mole resembles the common European mole in its habits, in leading a subterraneous life, forming galleries, throwing up little mounds of earth, and in feeding principally on earthworms and grubs. Dr Godman has given a detailed and interesting account of their manners, particularly of one which was domesticated by Mr Titian Peale. He mentions that they are most active early in the morning, at mid-day, and in the evening, and that they are well known in the country to have the custom of coming daily to the surface *exactly at noon*. They may then be taken alive by thrusting a spade beneath them, and throwing them on the surface; but can scarcely be caught at any other period of the day. The captive one in the possession of Mr Peale ate considerable quantities of fresh meat, either cooked or raw, drank freely, and was remarkably lively and playful, following the hand of its feeder by the scent, burrowing for a short distance in the loose earth, and, after making a small circle, returning for more food. When engaged in eating he employed his flexible snout in a singular manner to thrust the food into his mouth, doubling it so as to force it directly backwards. —*Dr Richardson's Zoology of North America.*

[3] The *Zemni, Blind Rat* of Pennant and Shaw, to which Guldenstaedt applied the Greek name, Spalax, has been hitherto referred to the mole. This singular animal attains nearly ten inches in length, and its cylindrical body is full two inches in diameter. Its thick head, nearly pyramidical, narrower in front, is terminated by a very hard and strong cartilaginous muzzle. The nostrils are round and narrow; the opening of the mouth is small. The incisive teeth are extremely prominent and strong, those in the lower jaw twice the length of the others; the under lip is shorter than the upper, and does not cover the teeth.

Aristotle has observed that externally there are no traces of eyes: if the skin of the head be taken off, a tendinous expansion may be perceived extending over the orbits, immediately under which is a glandulous body, oblong, a little flatted, toward the middle of which is a black spot representing the globe of the eye, and which appears perfectly well organized, though not half a line in thickness. Nothing in short appears wanting to constitute a perfect eye, but a greater developement of parts. Whether the spalax be absolutely blind, or whether it receive any perception of light through the medium of the eye as an organ, does not sufficiently appear by what has hitherto been said by its describers.

CHAP. II.

THE HEDGEHOG, OR PRICKLY KIND.

Animals of the Hedgehog kind require but very little accuracy to distinguish them from all others. That hair which serves the generality of quadrupeds for warmth and ornament is partly wanting in these; while its place is supplied by sharp spines or prickles, that serve for their defence. This general characteristic, therefore, makes a much more obvious distinction than any that can be taken from their teeth or their claws. Nature, by this extraordinary peculiarity, seems to have separated them in a very distinguished manner; so that, instead of classing the hedgehog among the moles, or the porcupine with the hare, as some have done, it is much more natural and obvious to place them, and others approaching them in this strange peculiarity, in a class by themselves: nor let it be supposed, that while I thus alter their arrangement, and separate them from animals with which they have been formerly combined, that I am destroying any secret affinities that exist in nature. It is natural, indeed, for readers to suppose, when they see two such opposite animals as the hare and the porcupine assembled together in the same group, that there must be some material reason, some secret connexion, for thus joining animals so little resembling each other in appearance. But the reasons for this union were very slight, and merely arose from a similitude in the fore-teeth: no likeness in the internal conformation, no similitude in nature, in habitudes, or disposition; in short, nothing to fasten the link that combines them, but the similitude in the teeth; this, therefore, may be easily dispensed with; and, as was said, it will be most proper to class them according to their most striking similitudes.

The hedgehog with an appearance the most formidable, is yet one of the most harmless animals in the world: unable or unwilling to to offend, all its precautions are only directed to its own security; and it is armed with a thousand points to keep off the enemy, but not to invade him. While other creatures trust to their force, their cunning, or their swiftness, this animal, destitute of all, has but one expedient for safety; and from this alone it often finds protection. As soon as it perceives itself attacked, it withdraws all its vulnerable parts, rolls itself into a ball, and presents nothing but its defensive thorns to the enemy; thus, while it attempts to injure no other quadruped, they are equally incapable of injuring it; like those knights we have somewhere read of, who were armed in such a manner, that they could neither conquer others, nor be themselves overcome.

This animal is of two kinds; one with a nose like the snout of a hog; the other more short and blunt, like that of a dog. That with the muzzle of a dog is the most common, being about six inches in length, from the tip of the nose to the insertion of the tail. The tail is little more than an inch long, and so concealed by the spines, as to be scarcely visible: the head, back, and sides, are covered with prickles: the nose, breast, and belly are covered with fine soft hair:[1] the legs are short, of a dusky colour, and almost bare: the toes on

---

The presence of what may be called the vestige of an organ. seems perfectly consistent with other instances, in which the application of such imperfect organs is not at all to be traced. On the contrary, it accords with that apparent unwillingness in nature to depart from prescribed laws. The total absence of an accustomed organ is much more anomalous in nature than the complete inutility of an imperfect one. So it seems with the spalax, which is not without the vestige of eyes, though their application as organs of sight seems doubtful. The spalax has the organs of hearing in a very perfect state. What is denied on the one hand is prodigally bestowed on the other, and the creature is thereby enabled to preserve its existence. The external ear, indeed, has but a very small outward expansion, but the auditory canal is very large, and the whole organ internally greatly developed. The neck of this animal is large, short, and muscular, by which the head is capable of considerable strength considered relatively to its size, and the whole animal takes a cylindrical shape; the feet are short, armed with round trenchant nails, rather larger on the hind feet, than on those before. The whole animal is covered with a short soft fur, the base of which is blackish ash-colour, and the extremity reddish, whence results a general tint of yellowish gray. They are sometimes found spotted with white.

The Greeks, as has been generally assumed, described the mole, ασπαλαξ as blind, an error which modern zoologists have piqued themselves in detecting. The ασπαλαξ of the Greeks was, however, doubtless, the animal now under consideration, which was indigenous in their country or around them, whereas the mole was an exotic in Greece. The Romans may bear the blame of having led us into this error by rendering the word ασπαλαξ into *talpa*, and applying that word to the mole of Europe.

The spalax lives gregariously underground. They bore excavations, which are not far from the surface, in search of food, but dig a hole lower in the earth for personal retreat and safety. They prefer cultivated grounds, and as they subsist principally, if not entirely on roots, they become serious destroyers of the fruits of agriculture. Their movements are precipitate, turning or running sideways, or even backward with facility, when driven and in danger, and they bite with great force and effect. When on the surface, they almost always carry the head raised apparently for the purpose more effectually of hearing what is passing around them; thus relying on their most perfect faculty for a forewarning of approaching danger, which they have not the means of detecting by sight.—*Supplement to the English edition of Cuvier's Animal Kingdom.*

[1] Præputium propendens. Linnæi Syst. 75. And of the female he might have said, resupina copulatur.—*Goldsmith.*

each foot are five in number, long and separated: the prickles are about an inch in length, and very sharp pointed; their lower part is white, the middle black, and the points white: the eyes are small, and placed high in the head: the ears are round, pretty large, and naked: the mouth is small, but well furnished with teeth; these however it uses in chewing its food, but neither in attacking or defending itself against other animals. Its only reliance, in cases of danger, is on its spines; the instant it perceives an enemy, it puts itself into a posture of defence, and keeps upon its guard, until it supposes the danger over. On such occasions, it immediately alters its whole appearance; from its usual form, somewhat resembling a small animal with a bunch on its back, the animal begins to bend its back, to lay its head upon its breast, to shut its eyes, to roll down the skin of its sides towards the legs, to draw these up, and lastly to tuck them in on every side, by drawing the skin still closer. In this form, which the hedgehog always puts on when disturbed, it no way resembles an animal, but rather a roundish mass of prickles impervious on every side. The shape of the animal thus rolled up, somewhat resembles a chestnut in the husk: there being, on one side, a kind of flat space, which is that on which the head and legs have been tucked in.

Such is the usual appearance of the hedgehog, upon the approach of any danger. Thus rolled up in a lump, it patiently waits till its enemy passes by, or is fatigued with fruitless attempts to annoy it. The cat, the weasel, the ferret, and the martin, quickly decline the combat; and the dog himself, generally spends his time in empty menaces, rather than in effectual efforts. Every increase of danger only increases the animal's precautions to keep on its guard; its assailant vainly attempts to bite, since he thus more frequently feels than inflicts a wound; he stands enraged and barking, and rolls it along with his paws; still, however, the hedgehog patiently submits to every indignity, but continues secure, and still more to disgust its enemy with the contest, sheds its urine, the smell of which is alone sufficient to send him away. In this manner, the dog, after barking for some time, leaves the hedgehog where he found him, who perceiving the danger past, at length peeps out from its ball, and if not interrupted, creeps slowly to its retreat.[1]

The hedgehog, like most other wild animals, sleeps by day, and ventures out by night. It generally resides in small thickets, in hedges, or in ditches covered with bushes: there it makes a hole of about six or eight inches deep, and lies well wrapped up in moss, grass, or leaves. Its food is roots, fruits, worms, and insects. It is also said to suck cattle and hurt their udders; but the smallness of its mouth will serve to clear it from this reproach. It is said also to be very hurtful in gardens and orchards, where it will roll itself in a heap of fruit, and so carry a large quantity away upon its prickles; but this imputation is as ill grounded as the former, since the spines are so disposed, that no fruit will stick upon them, even if we should try to fix them on. It rather appears to be a very serviceable animal, in ridding our fields of insects and worms, which are so prejudical to vegetation.

Mr Buffon, who kept these animals tame about his house, acquits them of the reproach of being mischievous in the garden, but then he accuses them of tricks, of which, from the form and habits of this animal, one would never be led to suspect them. "I have often," says he, "had the female and her young brought me about the beginning of June; they are generally from three to five in number: they are white in the beginning, and only the marks of their spines appear: I was willing to rear some of them, and accordingly put the dam and her young into a tub, with abundant provision beside them; but the old animal, instead of suckling her young, devoured them all one after another. On another occasion, a hedgehog that had made its way into the kitchen discovered a little pot in which there was meat prepared for boiling; the mischievous animal drew out the meat and left its excrements in the stead. I kept males and females in the same apartment, where they lived together but never coupled. I permitted several of them to go about my garden; they did very little damage, and it was scarcely perceivable that they were there; they lived upon the fruits that fell from the trees; they dug the earth into shallow holes; they eat caterpillars, beetles and worms; they were also very fond of flesh, which they devoured boiled or raw.[2]

---

[1] It is said that the hedgehog is proof against poison. M. Pallas states, that it will eat a hundred cantharides without receiving any injury. More recently, a German physician, who wished to dissect one, gave it prussic acid, but it took no effect; he then tried arsenic, opium, and corrosive sublimate, with the same results.

[2] Hedgehogs are said to scratch out young rabbits from their nests, and eat them. It has now been satisfactorily proved that they prey upon live animals, as Mr Woodcock, surgeon, Bury, Lancashire, found one with a live toad in his mouth, the head and one of the legs of which were consumed: and, in 1819, a labouring man of the name of Copland, on the lands of Terraughty, Dumfriesshire, overheard a sound which led him to believe a hare was in jeopardy from the attack of some unknown enemy; the squeaking, however, soon terminated; and, after searching carefully in all directions he detected a leveret lying dead by the side of a hedgehog.

They couple in spring, and bring forth about the beginning of summer. They sleep during the winter, and what is said of their laying up provisions for that season is consequently false. They at no time eat much, and can remain very long without any food whatsoever. Their blood is cold, like all other animals that sleep during the winter. Their flesh is not good for food; and their skins are converted to scarcely any use except to muzzle calves to keep them from sucking.

THE TANREC AND TENDRAC.

(*See Plate XII. fig.* 25.)

The Tanrec and Tendrac are two little animals, described by Mr Buffon, of the hedgehog kind; but yet sufficiently different from it to constitute a different species. Like the hedgehog, they are covered with prickles, though mixed in a greater proportion with hair; but unlike that animal, they do not defend themselves by rolling up in a ball. Their wanting this last property is alone sufficient to distinguish them from an animal in which it makes the most striking peculiarity; as also that in the East Indies, where only they are found, the hedgehog exists separately also; a manifest proof that this animal is not a variety caused by the climate.

The Tanrec is much less than the hedgehog,[1] being about the size of a mole, and covered with prickles, like that animal, except that they are shorter and smaller. The Tendrac is still less than the former, and is defended only with prickles upon the head, the neck, and the shoulders; the rest being covered with a coarse hair resembling a hog's bristles. These little animals, whose legs are very short, move but slowly. They grunt like a hog; and wallow like it in the mire. They love to be near water, and spend more of their time there than upon land. They are chiefly in creeks and harbours of salt water. They multiply in great numbers, make themselves holes in the ground, and sleep for several months. During this torpid state, their hairs (and I should also suppose their prickles) fall; and they are renewed upon their revival. They are usually very fat; and although their flesh be insipid, soft, and stringy, yet the Indians find it to their taste, and consider it as a very great delicacy.

THE PORCUPINE.[2]

Those arms which the hedgehog possesses in miniature, the Porcupine has in a more enlarged degree. The short prickles of the hedgehog are, in this animal, converted into shafts. In the one, the spines are about an inch long; in the other, a foot. The porcupine is about two feet long, and fifteen inches high. Like the hedgehog, it appears a mass of misshapen flesh, covered with quills from ten to fourteeen inches long, resembling the barrel of a goose-quill in thickness, but tapering and sharp at both ends. These, whether considered separately or together, afford sufficient subject to detain curiosity. Each quill is thickest in the middle; and inserted into the animal's skin, in the same manner as feathers are found to grow upon birds. It is within-side spongy, like the top of a goose-quill; and of different colours, being white and black alternately, from one end to the other. The biggest are often found fifteen inches long, and a quarter of an inch in diameter; extremely sharp, and capable of inflicting a mortal wound. They seem harder than common quills, being difficult to be cut, and solid at the end which is not fixed in the skin. If we examine them in common, as they grow upon the animal, they appear of two kinds, the one such as I have already described; the other, long, flexible, and slender, growing here and there among the former. There is still another sort of quills, that grow near the tail, white and transparent, like writing quills, and that seem to be cut short at the end. All these quills, of whatever kind, incline backwards, like the bristles of a hog; but when the animal is irritated, they rise, and stand upright, as bristles are seen to do.[3]

He had, however, coiled himself into the form of a ball on hearing footsteps advancing. Copland was so enraged at the sight, and being convinced the poor leveret had been burked by the hedgehog, that he instantly despatched him with a hatchet which he had in his hand. Mr Lane, gamekeeper to the Earl of Galloway, mentioned, in 1818, having seen a hedgehog cross a road, carrying on his back six pheasants' eggs, which he had pillaged from a nest hard by.

The hedgehog is not that stupid animal which many suppose it to be, as it has been trained to some curious tricks, and also becomes very domesticated. Mr Sample, of the Angel Inn, at Felton, Northumberland, had a tame hedgehog, which turned a spit as well in every respect as the dogs of that name which have been trained to the occupation.

Plutarch mentions a curious incident of a citizen of Cyzicus, who acquired the reputation of being an astonishing meteorologist. He discovered that a hedgehog generally has its burrow open at various points; and, warned by an instinct of an approaching atmospherical change, he stops up the opening next the quarter from whence the wind is to blow, and thus could predict to a certainty to which quarter the wind would shift.

[1] Buffon, vol. xxv. p. 251.

[2] For the Crested Porcupine, see Plate XII. fig. 50; for the Fasciculated Porcupine, see Plate XIV. fig. 13.

[3] Professor Thunberg, in his second journey to the island Mature in the Indian ocean, informs us, that the porcupine has a very curious method of fetching water for its young. The quills in the tail are said to be hollow, and to have a hole at the extremity: these the ani-

Such is the formation of this quadruped, in those parts in which it differs from most others: as to the rest of its figure, the muzzle bears some resemblance to that of a hare, but black: the legs are very short, and the feet have five toes, both before and behind; and these, as well as the belly, the head, and all other parts of the body, are covered with a sort of short hair, like prickles, there being no part, except the ears and the sole of the foot, that is free from them; the ears are thinly covered with very fine hair; and are in shape like those of mankind: the eyes are small like those of a hog, being only one-third of an inch from one corner to the other. After the skin is taken off, there appear a kind of paps on those parts of the body from whence the large quills proceed; these are about the size of a small pea, each answering to as many holes which appear on the outward surface of the skin, and which are about half an inch deep, like as many hollow pipes, wherein the quills are fixed, as in so many sheaths.

This animal seems to partake very much of the nature of the hedgehog;[1] having this formidable apparatus of arms rather to defend itself than annoy the enemy. There have been, indeed, many naturalists who supposed that it was capable of discharging them at its foes, and killing at a great distance off. But this opinion has been entirely discredited of late;

---

mal can bend in such a manner, as that they can be filled with water, which is afterwards discharged in the nest among its young.—*Note by Goldsmith.*

[1] The spiny clothing of the porcupine differs in its details from that of the hedgehog and the echidna of Australia, as, in the two latter, that of each has its own arrangement. It is the back of the porcupine only that is furnished with a panoply of spine. The head is ornamented with a long crest of slender tapering bristles, capable of being elevated or depressed at pleasure; and the fore and hinder limbs, as well as the under parts of the body, are clothed with stiff, short bristles, of a black colour, lying close upon the skin. The dorsal spines are of two kinds: some, which seem intended to form a sort of cloak to the others, are very long, weak, and slender, and incapable of inflicting injury; the main bed of spines, however, consists of shafts of great strength and solidity, from four to seven or eight inches in length, thick in the middle, and tapering to each end. The end inserted into the skin is formed into a small pedicle, the other end is extremely sharp and prolonged. Thus, by the action of a subcutaneous muscle, of great extent and considerable thickness, termed *panniculus carnosus*, the animal is capable of raising them, clashing them, or depressing them at pleasure. In their ordinary state, they lie nearly flat upon the body, with their points directed backwards, but, when elevated, they radiate in every direction. If we take one of these spines and examine it, we shall find that, in structure, it closely resembles the shaft of a quill-feather, except that it is more dense and hard; but internally it consists of a pithy substance, invested with a coat of hard enamel, of which the point is entirely composed. On looking at the point more narrowly, we shall see that it is somewhat flattened, so as to present a sort of slight double edge, or raised line, the one opposite the other, and these edges are minutely jagged, the whole constituting a weapon of no trifling nature. Not only is the wound it inflicts very painful, but it is often very serious. We know of an instance in which a person was struck through the boot and severely wounded, the injury being attended not only with great inflammation, but presenting for a long time very threatening appearance.

The spines of the porcupine are elegantly ringed with broad bands of black and white, and they make convenient "sticks" for camel-hair pencils, steel pens, &c.

Though invested with weapons of defence, the porcupine leads a quiet, inoffensive life, and is only formidable when assaulted by enemies. It leads a solitary life in obscure places, digging for itself a burrow in which it reposes during the day. Night is its season of activity. It then leaves its retreat to wander in search of food; this consists of roots, herbs, bark, &c; its strong and large incisor teeth enabling it to gnaw the hardest substances with ease. Capable of digging in the firmest ground, its limbs are extremely muscular, and the claws are short, thick, and strong. The fore feet are divided into four distinct toes, a claw indicating the rudiment of a fifth; on the hinder feet the toes are five in number.

The common porcupine (*Histrix cristata*, Linn.) is a native of Africa, but it is found also in several parts of Italy (near Rome and among the Apennines) and also in Spain. According to the best information, however, it is not originally indigenous in Europe, but has been imported; indeed the European specimens are inferior in size and in the strength of their spines to those of Africa, the climate of which is more congenial to their nature. In Europe they are said to undergo a partial hybernation, remaining torpid in their burrows during the severity of the winter, and appearing early in spring; but we are not aware that this takes place in Africa, indeed we have reason to suspect the contrary. Colonel Sykes, in his 'Catalogue of Animals from the Dukhun,' observes, that the Indian porcupine "appears to be distinct from the European species, which it closely resembles in form and covering. It is nearly a third larger; all the spines and tubes of the tail are entirely white, which is not the case in the *Histrix cristata.* The spines of the crest are also so long as to reach the insertion of the tail. The ears are much less rounded, and the nails are shorter, comparatively deeper, and more compressed with deep channels below. The white gular band is more marked; and finally the Asiatic species is totally destitute of hair: spines were wanting, being replaced by strong bristles even down to the nails. This species is abundant in Dukhun, and is very good eating. Like the African porcupine, when alarmed or irritated, it shakes the tubes and spines of its tail violently, producing a startling noise. It stamps also with great energy with its hind feet, and when it assails an adversary, it runs obliquely backwards, transfixing the foe with its spines."

In captivity the porcupine is dull, stupid, and inactive; it discovers no intelligence, and never becomes familiar. It has, however, bred in the Gardens of the Zoological Society. The length of the African porcupine is about two feet, its head is thick, the muzzle blunt, the eyes small. Its voice is a low grunt, uttered when teased or irritated.

and it is now universally believed that its quills remain firmly fixed in the skin, and are then only shed when the animal moults them, as birds do their feathers. It is true, we are told by Ellis, that a wolf at Hudson's Bay was found dead, with the quills of a porcupine fixed within its mouth; which might have very well happened, from the voraciousness of the former, and not the resentment of the latter. That rapacious creature, in the rage of appetite, might have attempted to devour the porcupine, quills and all, and very probably paid the forfeit by its life. However this be, of all the porcupines that have been brought into Europe, not one was ever seen to launch their quills; and yet the irritations they received were sufficient to have provoked their utmost indignation. Of all the porcupines that Dr Shaw observed in Africa, and he saw numbers, not one ever attempted to dart its quills; their usual manner of defence being, to lie on one side, and when the enemy approaches very near, by suddenly rising to wound him with the points on the other.[1]

It is probable, therefore, that the porcupine is seldom the aggressor; and when attacked by the bolder animals, it only directs its quills so as to keep always pointing towards the enemy. These are an ample protection; and, as we are assured by Kolben, at such times even the lion himself will not venture to make an attack. From such therefore, the porcupine can defend itself; and chiefly hunts for serpents, and all other reptiles, for subsistence. Travellers universally assure us, that between the serpent and the porcupine there exists an irreconcileable enmity, and that they never meet without a mortal engagement.[2] The porcupine, on these occasions, is said to roll itself upon the serpent, and thus destroy and devour it. This may be true; while what we are informed by Monsieur Sarrasin, of the porcupine of Canada chiefly subsisting on vegetables, may be equally so. Those which are brought to this country to be shown, are usually fed on bread, milk, and fruits; but they will not refuse meat when it is offered them; and it is probable they prefer it in a wild state, when it is to be had.[3] The porcupine is also known to be extremely hurtful to gardens; and, where it enters, does incredible damage.

The Americans, who hunt this animal, assure us, that the porcupine lives from twelve to fifteen years. During the time of coupling, which is in the month of September, the males become very fierce and dangerous, and often are seen to destroy each other with their teeth. The females goes with young seven months, and brings forth but one at a time; this she suckles but about a month, and accustoms it betimes to live, like herself, upon vegetables and the bark of trees: she is very fierce in its defence; but, at other seasons, she is fearful, timid, and harmless. The porcupine never attempts to bite, nor any way to injure its pursuers: if hunted by a dog or a wolf, it instantly climbs up a tree, and continues there until it has wearied out the patience of its adversary; the wolf knows, by experience, how fruitless it would be to wait; he therefore leaves the porcupine above, and seeks out for a new adventure. The porcupine does not escape so well from the Indian hunter, who eagerly pursues it, in order to make embroidery of its quills, and to eat its flesh. This, as we are commonly told, is very tolerable eating: however, we may expect wretched provisions when the savages are to be our caterers, for they eat every thing that has life. But they are very ingenious with regard to their embroidery: if I understand the accounts rightly, they dye the quills, of various colours, and then splitting them into slips, as we see in the making of a cane chair, they embroider with these their belts, baskets, and several other necessary pieces of furniture.

As to the rest, there are many things related concerning this animal that are fabulous; but there are still many circumstances more, that yet remain to be known. It were curious to inquire whether this animal moults its quills when wild, for it is never seen to shed them in a domestic state; whether it sleeps all the winter, as we are told by some naturalists, which we are sure it does not when brought into our country; and lastly, whether its quills can be sent off with a shake; for no less a naturalist than Reaumer was of that opinion.[4]

All that we can learn of an animal exposed as a show, or even by its dissection, is but merely its conformation: and that makes one of the least interesting parts of its history. We are naturally led, when presented with an extraordinary creature, to expect something extraordinary in its way of living, something uncommon, and corresponding with its figure;

---

[1] M. de Vaillant in his travels says, that owing to some pernicious quality in the quills, one of his Hottentots, who had received a wound in his leg from a porcupine, was ill for more than six months.

[2] Bosman. Smith. L. P. Vincent Marie, &c.

[3] Buffon.

[4] Bewick, in his General History of Quadrupeds, says, that upon the smallest irritation it raises its quills, and shakes them with great violence, directing them to that quarter from whence it is in danger of being attacked, and striking at the object of its resentment at the same time. "We have observed, on an occasion of this sort, at a time when the animal was moulting or casting its quills, that they would fly out to the distance of a few yards with such force as to bend the points of them against the board where they struck; and it is not improbable that a circumstance of this kind may have given rise to an opinion of its power to use them in a more effectual manner."

but of this animal we know little with any precision, except what it offers in a state of captivity. In such a situation, that which I saw appeared to very little advantage: it was extremely dull and torpid, though very wakeful and extremely voracious, though very capable of sustaining hunger; as averse to any attachment, as to being tamed: it was kept in an iron cage, and the touching one of the bars was sufficient to excite its resentment, for its quills were instantly erected, and the poet was right in his epithet of *fretful;* for it appeared to me the most irascible creature upon earth.

The porcupines of America differ very much from that of the ancient continent, which we have been describing; and, strictly speaking, may be considered as animals of a different species: however, from their being covered with quills, we will only add them as varieties of the former, since we know very little concerning them, except their difference of figure. They are of two kinds; the one called the *couando;* and the other, first named by Mr Buffon, the *urson;* the one a native of the northern parts of America; the other of the southern; and both differing from the former, in having long tails, whereas that has a very short one.

The COUANDO is much less than the porcupine; its quills are four times shorter, its snout more unlike that of a hare; its tail is long enough to catch by the branches of trees, and hold by them. It may be easily tamed, and it is to be found chiefly in the southern parts of America; yet is not wanting also in the northern.

The URSON, which Mr Buffon calls after our countryman Hudson, is a native of Hudson's Bay. The make of the body of this animal is not so round as that of the two former, but somewhat resembling the shape of a pig. It is covered with long bristly hair, with a shorter hair underneath; and under this the quills lie concealed very thick; they are white, with a brown point, and bearded, and the longest do not exceed four inches; they stick to the hand when the animal is stroked on the back; and likewise, when the hand is taken away, they stick so fast as to follow it. They make their nest under the roots of great trees, sleep very much, and chiefly feed upon the bark of the juniper. In winter the snow serves them for drink; and in summer they lap water like a dog. They are very common in the country lying to the east of Hudson's Bay; and several of the trading Americans depend on them for food, at some seasons of the year.

CHAP. III.

OF QUADRUPEDS COVERED WITH SCALES OR SHELLS INSTEAD OF HAIR.[1]

When we talk of a quadruped, the name seems to imply an animal covered with hair; when we mention a bird, it is natural to conceive a creature covered with feathers; when we hear of a fish, its scales are generally the first part that strikes our imagination. Nature, however, owns none of our distinctions; various in all her operations, she mixes her plans, groups her pictures, and excites our wonder, as well by her general laws as by her deviations. Quadrupeds, which we have considered as making the first general class in animated nature, and next to man, the most dignified tenants of the earth, are yet, in many respects, related to the classes beneath them, and do not in every respect, preserve their usual distinctions. Their first character, which consists in having four feet, is common to the lizard kind as well as to them. The second prerogative, which is that of bringing forth living young, is found in the cetaceous tribe of fishes, and also in insects without number. Their third and last attribute, which seems more general and constant than the former, that of being covered with hair, is yet found in various other animals, and is deficient in quadrupeds' themselves. Thus we must be cautious of judging of the nature of animals from one single character, which is always found incomplete; for it often happens that three or four of the most general characters will not suffice. It must be by a general enumeration of the parts that we can determine precisely of the works of the creation; and instead of definitions, learn to describe. Had this method been followed, much of the disgust and the intricacy of history might have been avoided, and that time which is now employed in combating error, laid out in the promoting of science.

Were we to judge of nature from definitions only, we should never be induced to suppose that there existed races of viviparous quadrupeds destitute of hair, and furnished with scales and shells in their stead. However, nature, every way various, supplies us with many instances of these extraordinary creatures; the old world has its quadrupeds covered with scales, and the new with a shell. In both they resemble each other, as well in the strangeness of their appetites, as in their awkward conformation. Like animals but partially made up, and partaking of different natures, they want those instincts which animals, formed but for one element alone, are found to possess. They seem to be a kind of strangers in nature, creatures taken from some other element, and capriciously thrown to find a precarious subsistence upon land.

---

[1] This chapter is chiefly extracted from Mr Buffon, which I mention at once, to save the trouble of repeated quotation.—*Goldsmith.*

THE PANGOLIN.

The Pangolin, which has been usually called the *scaly lizard*, Mr Buffon very judiciously restores to that denomination by which it is known in the countries where it is found. The calling it a lizard, he justly observes, might be apt to produce error, and occasion its being confounded with an animal which it resembles only in its general form and in its being covered with scales. The lizard may be considered as a reptile, produced from an egg; the pangolin is a quadruped, and brought forth alive, and perfectly formed. The lizard is all over covered with the marks of scales; the pangolin has scales neither on the throat, the breast, nor the belly. The scales of the lizard seem stuck upon the body even closer than those of fishes; the scales of the pangolin are only fixed at one end, and capable of being erected, like those of the porcupine, at the will of the animal. The lizard is a defenceless creature; the pangolin can roll itself into a ball, like the hedgehog, and present the points of its scales to the enemy, which effectually defend it.

The pangolin, which is a native of the torrid climates of the ancient continent, is, of all other animals, the best protected from external injury by nature. It is about three or four feet long; or, taking in the tail, from six to eight. Like the lizard, it has a small head, a very long nose, a short thick neck, a long body, legs very short, and a tail extremely long, thick at the insertion, and terminating in a point. It has no teeth, but is armed with five toes on each foot, with long white claws. But what it is chiefly distinguished by, is its scaly covering, which, in some measure, hides all the proportions of its body. These scales defend the animal on all parts, except the under part of the head and neck, under the shoulders, the breast, the belly, and the inner side of the legs; all which parts are covered with a smooth, soft skin, without hair. Between the shells of this animal, at all the interstices, are seen hairs like bristles, brown at the extremity, and yellow towards the root. The scales of this extraordinary creature are of different sizes and different forms, and stuck upon the body somewhat like the leaves of an artichoke. The largest are found near the tail, which is covered with them like the rest of the body. These are above three inches broad, and about two inches long, thick in the middle and sharp at the edges, and terminated in a roundish point. They are extremely hard, and their substance resembles that of horn. They are convex on the outside, and a little concave on the inner; one edge sticks on the skin, while the other laps over that immediately behind it. Those that cover the tail, conform to the shape of that part, being of a dusky brown colour, and so hard, when the animal has acquired its full growth, as to turn a musket-ball.

Thus armed, this animal fears nothing from the efforts of all other creatures, except man. The instant it perceives the approach of an enemy, it rolls itself up like the hedgehog, and presents no part but the cutting edges of its scales to the assailant. Its long tail, which at first view, might be thought easily separable, serves still more to increase the animal's security. This is lapped round the rest of the body, and, being defended with shells even more cutting than any other part, the creature continues in perfect security. Its shells are so large, so thick, and so pointed, that they repel every animal of prey; they make a coat of armour that wounds while it resists, and at once protects and threatens. The most cruel, the most famished quadruped of the forest, the tiger, the panther, and the hyæna, make vain attempts to force it. They tread upon, they roll it about, but all to no purpose; the pangolin remains safe within, while its invader almost always feels the reward of its rashness. The fox often destroys the hedgehog by pressing it with his weight, and thus obliges it to put forth its nose, which he instantly seizes, and soon after the whole body; but the scales of the pangolin effectually support it under any such weight, while nothing that the strongest animals are capable of doing can compel it to surrender. Man alone seems furnished with arms to conquer its obstinacy. The negroes of Africa, when they find it, beat it to death with clubs, and consider its flesh as a very great delicacy.

But although this animal be so formidable in its appearance, there cannot be a more harmless inoffensive creature when unmolested. It is even unqualified by nature to injure larger animals, if it had the disposition, for it has no teeth. It should seem that the bony matter, which goes in other animals to supply the teeth, is exhausted in this in supplying the scales that go to the covering of its body. However this be, its life seems correspondent to its peculiar conformation. Incapable of being carnivorous, since it has no teeth, or of subsisting on vegetables, which require much chewing, it lives entirely upon insects, for which nature has fitted it in a very extraordinary manner. As it has a long nose so it may naturally be supposed to have a long tongue; but, to increase its length still more, it is doubled in the mouth, so that when extended it is shot out to above a quarter of a yard beyond the tip of the nose. This tongue is round, extremely red, and covered with an unctuous and slimy liquor, which gives it a shining hue. When the pangolin, therefore, approaches an ant-hill, for these are the insects on which it chiefly feeds, it lies down near it, concealing as much as possible the place of its retreat, and stretching out its long tongue among the ants, keeps it for some time quite immovable. These little animals, allured by its appearance, and the unctuous substance with which it is smeared, instantly gather upon it in great numbers; and when the pangolin supposes a sufficiency, it quickly withdraws the tongue, and swallows them at once. This peculiar manner of hunting for its prey is repeated, either till it be satisfied, or till the ants, grown more cautious, will be allured to their destruction no longer. It is against these noxious insects, therefore, that its only force or cunning is exerted; and were the negroes but sufficiently sensible of its utility in destroying one of the greatest pests to their country, they would not be so eager to kill it. But it is the nature of savage men to pursue the immediate good, without being solicitous about the more distant benefit they remove. They, therefore, hunt this animal with the utmost avidity for its flesh; and as it is slow, and unable to escape in an open place, they seldom fail of destroying it. However, it chiefly keeps in the most obscure parts of the forest, and digs itself a retreat in the clefts of rocks, where it brings forth its young, so that it is but rarely met with, and continues a solitary species, and an extraordinary instance of the varying of nature.

Of this animal, there is a variety which is called the PHATAGIN, much less than the former, being not above a foot long from the head to the tail, with shells differently formed, with its belly, breast, and throat covered with hair, instead of a smooth skin, as in the former: but that by which it is peculiarly distinguished, is the extent of its tail, which is above twice the length of its body. Both are found in the warm latitudes of the East, as well as in Africa; and, as their numbers are but few, it is to be supposed their fecundity is not great.

THE ARMADILLO, OR TATOU.

(*See Plate XIV. fig.* 7.)

Having mentioned quadrupeds of the ancient continent covered with scales, we come next to quadrupeds of the new continent covered with shells. It would seem that Nature had reserved all the wonders of her power for these remote and thinly inhabited countries, where the men are savage, and the quadrupeds various. It would seem that she becomes more extraordinary in proportion as she retires from human inspection. But the real fact is, that wherever mankind are polished, or thickly planted, they soon rid the earth of these odd and half-formed productions, that in some measure encumber the soil. They soon disappear in a cultivated country, and continue to exist only in those remote deserts where they have no enemies but such as they are enabled to oppose.

The armadillo is chiefly an inhabitant of South America; a peaceful, harmless creature, incapable of offending any other quadruped, and furnished with a peculiar covering for its own defence. The pangolin, described above, seems an inactive, helpless being, indebted for safety more to its patience than its power; but the armadillo is still more exposed and helpless. The pangolin is furnished with an armour that wounds while it resists, and that is never attacked with impunity; but the armadillo is obliged to submit to every insult, without any power of repelling its enemy; it is attacked without danger, and is consequently liable to more various persecutions.

This animal being covered, like a tortoise, with a shell, or rather a number of shells its other proportions are not easily discerned. It appears, at first view, a round misshapen mass, with a long head, and a very large tail sticking out at either end, as if not of a piece with the rest of the body. It is of different sizes, from a foot to three feet long, and covered with a shell divided into several pieces, that lap over each other like the plaits in a coat of armour, or in the tail of a lobster. The difference in the size of this animal, and also the different disposition and number of its plaits, have been considered as constituting so many species, each marked with its own particular name. In all, however, the animal is partially covered with this natural coat of mail; the conformation of which affords one of the most striking curiosities in natural history. This shell, which in every respect resembles a bony substance, covers the head, the neck, the back, the sides, the rump, and the tail to the very point. The only parts to which it does not extend, are the throat, the breast, and the belly, which are covered with a white soft skin, somewhat resembling that of a fowl stripped of its feathers. If these naked parts be observed with attention, they will be found covered with the rudiments of shells, of the same substance with those which cover the back. The skin, even in the parts which are softest, seems to have a tendency to ossify; but a complete ossification takes place only on those parts which have the least friction, and are the most exposed to the weather. The shell, which covers the upper part of the body, differs from that of the tortoise, it being composed of more pieces than one, which lie in bands over the body, and, as in the tail of the lobster, slide over each other, and are connected by a yellow membrane in the same manner. By this means the animal has a motion in its back, and the armour gives way to its necessary inflexions. These bands are of various numbers and sizes, and from them these animals have been distinguished into various kinds. In general however, there are two large pieces that cover, one the shoulders, and the other the rump. In the back, between these, the bands are placed in different numbers, that lap over each other, and give play to the whole. Besides their opening cross-ways, they also open down along the back, so that the animal can move in every direction. In some there are but three of these bands between the large pieces; in others there are six; in a third kind there are eight; in a fourth kind, nine; in a fifth kind, twelve; and, lastly, in the sixth kind there is but one large piece, which covers the shoulders, and the rest of the body is covered with bands all down to the tail. These shells are differently coloured in different kinds, but most usually they are of a dirty gray. This colour, in all, arises from another peculiar circumstance in their conformation, for the shell itself is covered with a softish skin, which is smooth and transparent.

But, although these shells might easily defend this animal from a feeble enemy, yet they could make but a slight resistance against a more powerful antagonist; nature, therefore, has given the armadillo the same method of protecting itself with the hedgehog or the pangolin. The instant it perceives itself attacked, it withdraws the head under its shells, and lets nothing be seen but the tip of the nose; if the danger increases, the animal's precautions increase in proportion; it then tucks up its feet under its belly, unites its two extremities together, while the tail seems as a band to strengthen the connection; and it thus becomes like a ball, a little flattish on each side. In this position it continues obstinately fixed, while the danger is near, and often long after it is over. In this situation it is tossed about at the pleasure of every other quadruped, and very little resembling a creature endowed with life and motion. Whenever the Indians take it, which is mostly in this form, by laying it close to the fire, they soon oblige the poor animal to unfold itself, and to face a milder death to escape a more severe.

This animal is a native only of America, for they were utterly unknown before the discovery of that continent. It is an inoffensive harmless creature, unless it finds the way into a garden, where it does a great deal of mischief, by eating the melons, the potatoes, and other vegetables. Although a native of the warmest parts of America, yet it bears the cold of our climate without any inconvenience. We have often seen them shown among other wild beasts, which is a proof they are not difficult to be brought over. Their motion seems to be a swift walk, but they can neither run, leap, nor climb trees; so that, if found in an open place, they have no method of escaping from their pursuers. Their only resource in such an extremity is to make towards their hole as fast as they can; or, if this be impracticable, to make a new hole before the enemy arrives. For this they require but a very few moments' advantage; the mole itself does not burrow swifter than they can. For this purpose, they are furnished with claws extremely large, strong, and crooked, and usually four upon each foot. They are sometimes caught by the tail as they are making their way into the earth; but such is their resistance, and so difficult is it to draw them backward, that they leave their tail in the hand of their pursuer, and are very well contented to save their lives with its loss. The pursuers, sensible of this, never drag the tail with all their force, but hold it while another digs the ground about them, and thus these animals are taken alive. The instant the armadillo perceives itself in the power of its enemies, it has but one last resource, to roll itself up, and thus patiently wait whatever tortures they think proper to inflict. The flesh of the smaller kinds is said to be delicate eating; so that we may suppose they receive no mercy. For this reason they are pursued with unceasing industry; and, although they burrow very deep in the earth, there have been many expedients used to force them out. The hunters sometimes contrive to fill the hole with smoke, which is often successful; they at other times force it by pouring in water. They also bring up a small kind of dogs to the chase, that quickly overtake them, if at any distance from their burrow, and oblige them to roll themselves up in a ball, in which figure the hunters carry them home. If, however, the armadillo be near a precipice, it often escapes by rolling itself up, and then tumbling down from rock to rock, without the least danger or inconvenience. They are sometimes taken in snares laid for them by the sides of rivers and low moist places, which they particularly frequent; and this method, in general, succeeds better than any of the former, as their burrows are very deep, and they seldom stir out except in the night.

At no time are they found at any great distance from their retreats, so that it requires some patience and skill to intercept their retreat.

There are scarcely any of these that do not root the ground like a hog, in search of such roots as make a principal part of their food. They live also upon melons and other succulent vegetables, and all will eat flesh when they can get it. They frequent water and watery places, where they feed upon worms, small fish, and water insects. It is pretended that there is a kind of friendship between them and the rattle-snake, that they live peaceably and commodiously together, and are frequently found in the same hole. This, however, may be a friendship of necessity to the armadillo; the rattle-snake takes possession of its retreats, which neither are willing to quit, while each is incapable of injuring the other.

As to the rest, these animals, though they all resemble each other in the general character of being clothed with a shell, yet differ a good deal in their size, and in the parts into which their shell is divided. The first of this kind, which has but three bands between the two large pieces that cover the back, is called the TATU APARA. I will not enter into an exact description of its figure, which, how well written soever, no imagination could exactly conceive; and the reader would be more fatigued to understand, than I to write it. The tail is shorter in this than any other kind, being not more than two inches long, while the shell, taking all the pieces together, is a foot long, and eight inches broad. The second is the TATOU of Ray, or the ENCOUBERT of Buffon; this is distinguished from the rest by six bands across the back; it is about the size of a pig of a month old, with a small long head and a very long tail. The third is the TATUETTE, furnished with eight bands, and not by a great deal so big as the former. Its tail is longer also, and its legs shorter in proportion. Its body from the nose to the insertion of the tail, is about ten inches long, and the tail seven. The fourth in the PIG-HEADED ARMADILLO, with nine bands. This is much larger than the former, being about two feet long from the nose to the tail. The fifth is the KABASSOU, or CATAPHRACTUS, with twelve bands, and still bigger than the former, or any other of its kind. This is often found above three feet long; but is never eaten as the rest are. The sixth is the WEASEL-HEADED ARMADILLO, with eighteen bands, with a large piece before, and nothing but bands backward. This is above a foot long, and the tail five inches. Of all these, the kabassou and the encoubert are the largest; the rest are of a much smaller kind. In the larger kinds, the shell is much more solid than in the others, and the flesh is much harder and unfit for the table. These are generally seen to reside in dry upland grounds, while the small species are always found in moist places, and in the neighbourhood of brooks and rivers. They all roll themselves into a ball; but those whose bands are fewest in number, are least capable of covering themselves up completely. The tatu apara, for instance, when rolled up, presents two great interstices between its bands, by which it is very easily vulnerable, even by the feeblest of quadrupeds.

CHAP. IV

ANIMALS OF THE BAT KIND.

Having in the last chapter described a race of animals that unite the boundaries between quadrupeds and insects, I come in this to a very different class, that serve to fill up the chasm between quadrupeds and birds. Some naturalists, indeed, have found animals of the bat kind so much partaking of the nature of both, that they have been at a loss in which rank to place them, and have doubted, in giving the history of the bat, whether it was a beast or a bird they were describing. These doubts, however, no longer exist; they are now universally made to take their place among quadrupeds, to which their bringing forth their young alive, their hair, their teeth, as well as the rest of their habitudes and conformation, evidently entitle them. Pliny, Gesner, and Aldrovandus, who placed them among birds, did not consider that they wanted every character of that order of animals, except the power of flying. Indeed, when this animal is seen with an awkward and struggling motion supporting itself in the air at the dusk of the evening, it presents in some measure the appearance of a bird; but naturalists, whose business it is to examine it more closely, to watch its habitudes, and inspect into its formation, are inexcusable for concurring in the mistake.

The bat in scarcely any particular resembles the bird, except in its power of sustaining itself in the air. It brings forth its young alive; it suckles them; its mouth is furnished with teeth; its lungs are formed like those of quadrupeds; its intestines and its skeleton have a complete resemblance, and even are, in some measure, seen to resemble those of mankind.[1]

The bat most common in England, is about the size of a mouse; or nearly two inches and a half long. The membranes that are usually called wings, are, properly speaking, an extension of the skin all round the body, except the head, which, when the animal flies, is kept stretched on every side by the four interior toes of the fore feet, which are enormously long, and serve like masts that keep the canvass of a sail spread, and regulate its motions.[1] The first toe is quite loose, and serves as a heel when the bat walks : or as a hook, when it would adhere to any thing. The hind feet are disengaged from the surrounding skin, and divided into five toes, somewhat resembling those of a mouse. The skin by which it flies is of a dusky colour. The body is covered with a short fur of a mouse colour, tinged with red. The eyes are very small; the ears like those of a mouse.

---

[1] Penis propendens.

This species of the bat is very common in England. It makes its first appearance early in summer, and begins its flight in the dusk of the evening. It principally frequents the sides of woods, glades, and shady walks ; and is frequently observed to skim along the surface of pieces of water. It pursues gnats, moths, and nocturnal insects of every kind. It feeds upon these; but will not refuse meat whenever it can find it. Its flight is a laborious irregular movement; and if it happens to be interrupted in its course it cannot readily prepare for a second elevation ; so that if it strikes against any object, and falls to the ground, it is usually taken. It appears only in the most pleasant evenings, when its prey is generally abroad, and flies in pursuit with its mouth open. At other times it continues in its retreat; the chink of a ruined building, or the hollow of a tree. Thus this little animal, even in summer, sleeps the greater part of its time, never venturing out by day-light, nor in rainy weather; never hunting in quest of prey, but for a small part of the night, and then returning to its hole. But its short life is still more abridged by continuing in a torpid state during the winter. At the approach of the cold season, the bat prepares for its state of lifeless inactivity, and seems rather to choose a place where it may continue safe from interruption, than where it may be warmly or conveniently lodged. For this reason it is usually seen hanging by its hooked claws to the roofs of caves, regardless of the eternal damps that surround it. The bat seems the only animal that will venture to remain in these frightful subterranean abodes, where it continues in a torpid state, unaffected by every change of the weather. Such of this kind as are not provident enough to procure themselves a deep retreat, where the cold and heat seldom vary, are sometimes exposed to great inconveniences, for the weather often becomes so mild in the midst of winter, as to warm them prematurely into life, and to allure them from their hole in quest of food, when nature has not provided a supply. These, therefore, have seldom strength to return; but having exhausted themselves in a vain pursuit after insects which are not to be found, are destroyed by the owl, or any other animal that follows such petty prey.

The bat couples and brings forth in summer, generally from two to five at a time: of this I am certain, that I have found five young ones in a hole together; but whether they were the issue of one parent, I cannot tell. The female has but two nipples, and those forward on the breast as in the human kind. This was a sufficient motive for Linnæus to give it the title of a *primus*, to rank it in the same order with mankind, and to push this contemptible animal among the chiefs of the creation. Such arbitrary associations produce rather ridicule than instruction, and render even method contemptible; however, we are to forgive too strong an attachment to system in this able naturalist, since his application to the particular history of the animal counterbalances the defect.[2]

From Linnæus we learn, that the female makes no nest for her young, as most birds and quadrupeds are known to do. She is barely content with the first hole she meets, where sticking herself by her hooks against the sides of her apartment, she permits her young to hang at the nipple, and in this manner to continue for the first or second day. When, after some time, the dam begins to grow hungry, and finds a necessity of stirring abroad, she takes her little ones and sticks them to the wall, in the manner she before hung herself; there they immovably cling, and patiently wait till her return.

Thus far this animal seems closely allied to the quadruped race. Its similitude to that of birds is less striking. As nature has furnished birds with extremely strong pectoral muscles, to move the wings, and direct their flight, so has it also furnished this animal. As birds also have their legs weak, and unfit for the purposes of motion, the bat has its legs fashioned in the same manner, and is never seen to walk, or, more properly speaking, to push itself forward with its hind legs, but in cases of extreme necessity. The toes of the fore legs, or, if we may use the expression, its extremely long fingers, extend the web like a membrane that lies between them; and this, which is extremely thin, serves to lift the little body into the air: in this manner, by an unceasing percussion, much swifter than that of birds, the animal continues, and directs its flight; however, the great labour required in flying, soon fatigues it; for, unlike birds, which continue for days together upon the wing, the bat is tired in less than an hour, and then returns to its hole, satisfied with its supply, to enjoy the darkness of its retreat.

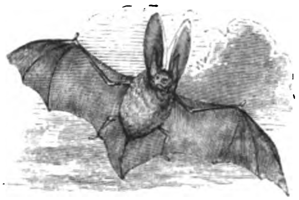
---

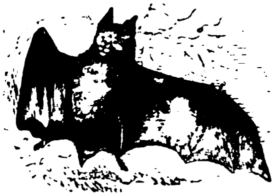
[1] British Zoology.

[2] Fauna Suecica, p. 8.

If we consider the bat as it is seen in our country, we shall find it a harmless inoffensive creature. It is true that it now and then steals into a larder, and, like a mouse, commits its petty thefts upon the fattest parts of the bacon. But this happens seldom; the general tenor of its industry is employed in pursuing insects that are much more noxious to us than itself can possibly be: while its evening flight, and its unsteady wabbling motion, amuse the imagination, and add one figure more to the pleasing group of animated nature.

The varieties of this animal, especially in our country, are but few; and the differences scarcely worth enumeration. Naturalists mention the Long-eared Bat, much less than that generally seen, and with much longer ears; the Horse-shoe Bat, with an odd protuberance round its upper lip, somewhat in the form of a horse-shoe; the Rhinoceros Bat, with a horn growing from the nose, somewhat similar to that animal from whence it has the name. These, with several others, whose varieties are too numerous, and differences too minute for a detail, are all inoffensive, minute, and contemptible; incapable, from their size, of injuring mankind, and not sufficiently numerous much to incommode him. But there is a larger race of bats, found in the East and West Indies, that are truly formidable; each of these is singly a dangerous enemy, but when they unite in flocks, they then become dreadful. Were the inhabitants of the African coasts,[1] says Des Marchais, to eat animals of the bat kind, as they do in the East Indies, they would never want a supply of provisions. They are there in such numbers, that, when they fly, they obscure the setting sun. In the morning, at peep of day, they are seen sticking upon the tops of the trees, and clinging to each other, like bees when they swarm, or like large clusters of cocoa. The Europeans often amuse themselves with shooting among this huge mass of living creatures, and observing their embarrassment when wounded. They sometimes enter the houses, and the negroes are expert at killing them; but although these people seem for ever hungry, yet they regard the bat with horror, and will not eat it, though ready to starve.





Of foreign bats, the largest we have any certain accounts of, is the Rousette, or the Great Bat of Madagascar. This formidable creature is near four feet broad, when the wings are extended; and a foot long, from the tip of the nose to the insertion of the tail. It resembles our bat in the form of its wings, in its manner of flying, and in its internal conformation. It differs from it in its enormous size, in its colour, which is red, like that of a fox; in its head and nose also, which resemble those of that animal, and which have induced some to call it the flying fox; it differs also in the number of its teeth; and in having a claw on the fore foot, which is wanting in ours. This formidable creature is found only in the ancient continent; particularly in Madagascar, along the coasts of Africa and Malabar, where it is usually seen about the size of a large hen. When they repose, they stick themselves to the tops of the tallest trees, and hang with their heads downward. But when they are in motion, nothing can be more formidable: they are seen in clouds, darkening the air, as well by day as by night, destroying the ripe fruits of the country, and sometimes settling upon animals, and man himself: they devour, indiscriminately, fruits, flesh, and insects, and drink the juice of the palm-tree; they are heard at night in the forests at more than two miles' distance, with a horrible din, but at the approach of day they usually begin to retire: nothing is safe from their depredations; they destroy fowls and domestic animals, unless preserved with the utmost care, and often fasten upon the inhabitants themselves, attack them in the face, and inflict very terrible wounds. In short, as some have already observed, the ancients seem to have taken their ideas of harpies from these fierce and voracious creatures, as they both concur in many parts of the description, being equally deformed, greedy, uncleanly, and cruel.

An animal not so formidable, but more mischievous than these, is the American Vampyre. This is still less than the former, but more deformed, and still more numerous. It is furnished with a horn like the rhinoceros bat; and its ears are extremely long. The other kinds generally resort to the forest, and the most deserted places; but these come into towns and cities, and, after sunset, when they begin to fly, cover the streets like a canopy.[1] They are the common pest both of men and animals; they effectually destroy the one, and often distress the other. "They are," says Ulloa, "the most expert blood-letters in the world. The inhabitants of those warm latitudes being obliged, by the excessive heats, to leave open the doors and windows of the chambers where they sleep, the vampyres enter, and if they find any part of the body exposed, they never fail to fasten upon it. There they continue to suck the blood; and it often happens that the person dies under the operation. They insinuate their tooth into a vein, with all the art of the most experienced surgeon, continuing to exhaust the body until they are satiated. I have been assured," continues he, "by persons of the strictest veracity, that such an accident has happened to them; and that had they not providentially awaked, their sleep would have been their passage into eternity; having lost so large a quantity of blood as hardly to find strength to bind up the orifice. The reason why the puncture is not felt, is, besides the great precautions with which it is made, the gentle refreshing agitation of the bat's wings, which contribute to increase sleep, and soften the pain."

---

[1] Des Marchais, vol. ii. p. 208.

The purport of this account has been confirmed by various other travellers; who all agree that this bat is possessed of a faculty of drawing the blood from persons sleeping; and thus often destroying them before they awake. But still a very strong difficulty remains to be accounted for; the manner in which they inflict the wound. Ulloa, as has been seen, supposes that it is done by a single tooth; but this we know to be impossible, since the animal cannot infix one tooth without all the rest accompanying its motions; the teeth of the bat kind being pretty even, and the mouth but small. Mr Buffon, therefore, supposes the wound to be inflicted by the tongue; which, however, appears to me too large to inflict an unpainful wound; and even less qualified for that purpose than the teeth. Nor can the tongue, as Mr Buffon seems to suppose, serve for the purposes of suction, since for this it must be hollow, like a syringe, which it is not found to be.[2] I should therefore suppose, that the animal is endowed with a strong power of suction; and that, without inflicting any wound whatsoever, by continuing to draw, it enlarges the pores of the skin in such a manner, that the blood at length passes, and that more freely the longer the operation is continued; so that, at last, when the bat goes off, the blood continues to flow. In confirmation of this opinion we are told, that where beasts have a thick skin, this animal cannot injure them; whereas, in horses, mules, and asses, they are very liable to be thus destroyed, As to the rest, these animals are considered as one of the great pests of South America; and often prevent the peopling of many parts of that continent: having destroyed at Barja, and several other places, such cattle as were brought there by the missionaries, in order to form a settlement.

CHAP. V.

OF AMPHIBIOUS QUADRUPEDS.

The gradations of nature, from one class of beings to another, are made by imperceptible deviations. As we saw, in the foregoing chapters, quadrupeds almost degraded into the insect tribe, or mounted among the inhabitants of the air, we are at present to observe their approach to fishes, to trace the degrees by which they become more unlike terrestrial animals, till the similitude of the fish prevails over that of the quadruped.

As in opposite armies the two bodies are distinct and separated from each other, while yet between them are various troops that plunder on both sides, and are friends to neither; so between terrestrial and aquatic animals there are tribes that can scarcely be referred to any rank, but lead an amphibious life between them. Sometimes in water, sometimes on land, they seem fitted for each element, and yet completely adapted to neither. Wanting the agility of quadrupeds upon land, and the perseverance of fishes in the deep, the variety of their powers only seems to diminish their force; and, though possessed of two different methods of living, they are more inconveniently provided than such as have but one.

All quadrupeds of this kind, though covered with hair in the usual manner, are furnished with membranes between the toes, which assist their motion in the water. Their paws are broad, and their legs short, by which they are more completely fitted for swimming; for, taking short strokes at a time, they make them oftener and with greater rapidity. Some, however, of these animals are more adapted to live in the water than others; but, as their power increases to live in the deep, their unfitness for living upon land increases in the same proportion. Some, like the otter, resemble quadrupeds in every thing except in being in some measure web-footed; others depart still farther, in being, like the beaver, not only web-footed, but having the tail covered with scales, like those of a fish. Others depart yet farther, as the seal and the morse, by having the hind feet stuck to the body like fins; and others, as the lamentin, almost entirely resemble fishes, by having no hind feet whatsoever. Such are the gradations of the amphibious tribe. They all, however, get their living in the water, either by habit or conformation; they all continue a long time under water; they all consider that element as their proper abode; whenever pressed by danger, they fly to the water for security; and, when upon land, appear watchful, timorous, and unwieldly.

---

[1] Ulloa, vol. i. p. 58.

[2] A portion of the tongue has now been discovered to be exactly constituted as an organ of suction, which confirms the conjecture of Buffon.

THE OTTER.[1]

In the first step of the progression from land to amphibious animals, we find the Otter, resembling those of the terrestrial kind in shape, hair, and internal conformation; resembling the aquatic tribes in its manner of living, and in having membranes between the toes to assist it in swimming. From this peculiar make of its feet, which are very short, it swims even faster than it runs, and can overtake fishes in their own element. The colour of this animal is brown; and it is somewhat of the shape of an overgrown weasel, being long, slender, and soft skinned. However, if we examine its figure in detail, we shall find it unlike any other animal hitherto described, and of such a shape as words can but weakly convey. Its usual length is about two feet, from the tip of the nose to the insertion of the tail; the head and nose are broad and flat; the mouth bears some similitude to that of a fish; the neck is short, and equal in thickness to the head; the body long; the tail broad at the insertion, but tapering off to a point at the end; the eyes are very small, and placed nearer the nose than usual in quadrupeds. The legs are very short, but remarkably strong, broad, and muscular. The joints are articulated so loosely, that the animal is capable of turning them quite back, and bringing them on a line with the body, so as to perform the office of fins. Each foot is furnished with five toes, connected by strong broad webs like those of water fowl. Thus nature, in every part, has had attention to the life of an animal whose food is fish, and whose haunts must necessarily be about water.

This voracious animal is never found but at the sides of lakes and rivers, but particularly the former, for it is seldom fond of fishing in a running stream, for the current of the water having more power upon it than the fishes it pursues, if it hunts against the stream, it swims too slow; and if with the stream, it overshoots its prey. However, when in rivers, it is always observed to swim against the stream, and to meet the fishes it preys upon, rather than to pursue them. In lakes it destroys much more than it devours, and is often seen to spoil a pond in the space of a few nights. But the damage they do by destroying fish is not so great as their tearing in pieces the nets of the fishers, which they infallibly do whenever they happen to be entangled. The instant they find themselves caught, they go to work with their teeth, and in a few minutes destroy nets of a very considerable value.

The otter has two different methods of fishing; the one by catching its prey from the bottom upward, the other by pursuing it into some little creek, and seizing it there. In the former case, as this animal has longer lungs than most other quadrupeds, upon taking in a quantity of air, it can remain for some minutes at the bottom; and whatever fish passes over at that time is certainly taken; for as the eyes of fish are placed so as not to see under them, the otter attacks them off their guard from below; and, seizing them at once by the belly, drags them on shore, where it often leaves them untouched, to continue the pursuit for hours together. The other method is chiefly practised in lakes and ponds, where there is no current: the fish thus taken are rather of the smaller kind, for the great ones will never be driven out of deep water.

In this manner the otter usually lives during the summer, being furnished with a supply much greater than its consumption; killing for its amusement, and infecting the edges of the lake with quantities of the dead fish, which it leaves there as trophies rather of its victory than its necessities. But in winter, when the lakes are frozen over, and the rivers pour with a rapid torrent, the otter is often greatly distressed for provisions; and is then obliged to live upon grass, weeds, and even the bark of trees. It then comes upon land, and, grown courageous from necessity, feeds upon terrestrial animals, rats, insects and even sheep themselves. Nature, however, has given it the power of continuing a long time without food; and although, during that season, it is not rendered quite torpid, like the marmout or dormouse, yet it keeps much more within its retreat, which is usually the hollow of a bank, worn under by the water. There it often forms a kind of gallery, running for several yards along the edge of the water: so that when attacked at one end, it flies to the other, and often evades the fowler by plunging into the water at forty or fifty paces distance, while he expects to find it just before him.

---

[1] The otter differs in no respect from the weasel kind, except in having the feet webbed, and in living almost constantly in the water, from whence they chiefly derive their food, which is fish.

We learn from Mr Buffon, that this animal, in France, couples in winter, and brings forth in the beginning of spring. But it is certainly different with us, for its young are never found till the latter end of summer; and I have frequently, when a boy, discovered their retreats, and pursued them at that season. I am, therefore, more inclined to follow the account given us of this animal by Mr Lots, of the Academy of Stockholm, who assures us that it couples about the middle of summer, and brings forth at the end of nine weeks, generally three or four at a time. This, as well as the generality of his other remarks on this subject, agrees so exactly with what I remember concerning it, that I will beg leave to take him for my guide, assuring the reader that, however extraordinary the account may seem, I know it to be certainly true.

In the rivers and the lakes frequented by the otter, the bottom is generally stony and uneven, with many trunks of trees, and long roots stretching underneath the water.[1] The shore also is hollow and scooped inward by the waves. These are the places the otter chiefly chooses for its retreat; and there is scarcely a stone which does not bear the mark of its residence, as upon them its excrements are always made. It is chiefly by this mark that its lurking-places are known, as well as by the quantity of dead fish that are found lying here and there upon the banks of the water. To take the old ones alive is no easy task, as they are extremely strong, and there are few dogs that will dare to encounter them. They bite with great fierceness, and never let go their hold when they have once fastened. The best way therefore is to shoot them at once, as they never will be thoroughly tamed; and, if kept for the purposes of fishing, are always apt to take the first opportunity of escaping. But the young ones may be more easily taken, and converted to very useful purposes. The otter brings forth its young generally under the hollow banks, upon a bed of rushes, flags, or such reeds as the place affords in the greatest quantities. I see in the British Zoology a description of its habitation, where that naturalist observes, "that it burrows under ground, on the banks of some river or lake, and always makes the entrance of its hole under water, then works up to the surface of the earth, and there makes a minute orifice for the admission of air, and this little air-hole is often found in the middle of some thicket." In some places this may be true, but I have never observed any such contrivance; the retreat, indeed, was always at the edge of the water, but it was only sheltered by the impending bank; and the otter itself seemed to have but a small share in its formation. But be this as it may, the young ones are always found at the edge of the water; and, if under the protection of the dam, she teaches them instantly to plunge, like herself, into the deep, and escape among the rushes or weeds that fringe the stream. At such times, therefore, it is very difficult to take them; for, though ever so young, they swim with great rapidity, and in such a manner that no part of them is seen above water, except the tip of the nose. It is only when the dam is absent that they can be taken; and in some places, there are dogs purposely trained for discovering their retreats. Whenever the dog comes to the place, he soon, by his barking, shows that the otter is there; which, if there be an old one, instantly plunges into the water, and the young all follow. But if the old one be absent, they continue terrified, and will not venture forth but under her guidance and protection. In this manner they are secured, and taken home alive, where they are carefully fed with small fish and water. In proportion, however, as they gather strength, they have milk mixed among their food, the quantity of their fish provision is retrenched, and that of vegetables is increased, until at length they are fed wholly upon bread, which perfectly agrees with their constitution. The manner of training them up to hunt for fish requires not only assiduity, but patience; however, their activity and use, when taught, greatly repays the trouble of teaching; and, perhaps, no other animal is more beneficial to its master. The usual way is, first to learn them to fetch, as dogs are instructed; but, as they have not the same docility, so it requires more art and experience to teach them. It is usually performed by accustoming them to take a truss stuffed with wool, of the shape of a fish, and made of leather, in their mouths, and to drop it at the word of command; to run after it when thrown forward, and to bring it to their master. From this they proceed to real fish, which are thrown dead into the water, and which they are taught to fetch from thence. From the dead they proceed to the live, until at last the animal is perfectly instructed in the whole art of fishing. An otter thus taught is a very valuable animal, and will catch fish enough to sustain not only itself but a whole family. I have seen one of these go to a gentleman's pond at the word of command, drive up the fish into a corner, and seizing upon the largest of the whole, bring it off, in its mouth, to its master.

---

[1] Journal Etranger, Juin, 1755. p. 14.

Otters are to be met with in most parts of the world, and rather differ in size and colour from each other, than in habitudes or conformation.[1] In North America, and Carolina, they are usually found white, inclining to yellow. The Brasilian otter is much larger than ours, with a roundish head, almost like a cat. The tail is shorter, being but five inches long; and the hair is soft, short, and black, except on the head, where it is of a dark brown, with a yellowish spot under the throat.[2]

THE BEAVER.

(*See Plate XII. fig.* 43.)

In all countries, as man is civilized and improved, the lower ranks are repressed and degraded.[3] Either reduced to servitude, or treated as rebels, all their societies are dissolved, and all their united talents rendered ineffectual. Their feeble arts quickly disappear, and nothing remains but their solitary instincts, or those foreign habitudes which they receive from human education. For this reason there remain no traces of their ancient talents and industry, except in those countries where man himself is a stranger; where, unvisited by his controlling power, for a long succession of ages, their little talents have had time to come to their limited perfection, and their common designs have been capable of being united.

The beaver seems to be now the only remaining monument of brutal society. From the result of its labours, which are still to be seen in the remote parts of America, we learn how far instinct can be aided by imitation. We from thence perceive to what a degree animals, without language or reason, can concur for their mutual advantage, and attain by numbers those advantages which each in a state of solitude seems unfitted to possess.[4]

If we examine the beaver merely as an

---

[1] Ray.

[2] *The Sea Otter.*—The whole length of the sea otter is generally about four feet, of which the tail occupies thirteen inches. The fur is extremely soft, and of a deep glossy black. The ears are small, and erect, and the whiskers long and white. The legs are short and thick, the hinder ones somewhat resembling those of a seal. The weight of the largest sea otters is from seventy to eighty pounds. In their general habits of life these animals are perfectly harmless and inoffensive; and towards their offspring they exhibit a degree of attachment which is extremely interesting. They will never desert them; they will even starve themselves to death on being robbed of them, and strive to breathe their last on the spot where their young have been destroyed. The female produces only a single young one at a time, which she suckles almost a whole year, and till it takes to itself a mate. The sea otters pair, and are very constant. They often carry their young between their teeth, and fondle them, frequently throwing them up, and catching them again in their paws. Before these can swim, the old ones will take them in their fore-feet, and swim about with them on their backs. The sea otters swim sometimes on their sides; at other times on their backs, or in an upright position. They are very sportive, embrace each other, and seem to kiss. When attacked they make no resistance, but endeavour to save themselves by flight: if, however, they are closely pressed, and can see no means of escape, they scold and grin like an angry cat. On receiving a blow, they immediately lie on their side, draw up their hind legs together, cover their eyes with their fore paws, and thus seem to prepare for death. But if they are fortunate enough to escape their pursuer, they deride him as soon as they are safe in the sea, with various diverting tricks; at one time keeping themselves on end in the water, and jumping over the waves, holding the fore paw over the eyes, as if to shade them from the sun while looking out for their enemy; then lying flat on their back, and stroking their belly; then throwing their young down into the water, and fetching them up again. In their escape they carry the sucklings in their mouths, and drive before them those that are full-grown. The skins of the sea otters are of great value, and have long formed a considerable export from Russia. They are disposed of to the Chinese at the rate of eighty or a hundred rubles each.—The trade for this fur at Nootka had, not many years ago, nearly produced a war between Great Britain and Spain. These animals are found on the coast of Kamtschatka, and in the adjacent islands, as well as on the opposite coasts of America; but they are confined within a very few degrees of latitude.

[3] Buffon.

[4] The general aspect of the beaver, at first view, would remind one of a very large rat, and seen at a little distance it might be readily mistaken for the common musk-rat. But the greater size of the beaver, the thickness and breadth of its head, and its horizontally flattened, broad and scaly tail, render it impossible to mistake it, when closely examined, for any other creature.

Their extraordinary instincts are applied to two principal objects: 1. To secure a sufficient depth of water to prevent it from being frozen to the bottom; 2. To construct huts, in which they pass the winter.

If beavers choose a spot for their residence where the water is not of sufficient depth, they set about obviating the inconvenience by building a dam. The materials used for the construction of their dams are the trunks and branches of small birch, mulberry, willow, poplar, &c. They begin to cut down their timber for building early in the summer, but their edifices are not commenced until about the middle or latter part of August, and are not completed until the beginning of the cold season. The strength of their teeth and their perseverance in this work, may be fairly estimated by the size of the trees they cut down. Dr Best informs us that he has seen a mulberry-tree, eight inches in diameter, which had been gnawed down by the beaver. Dr Godman saw, while on the banks of the Little Miami river, several stumps of trees, which had evidently been felled by these animals, of at least five or six inches in diameter. These are cut in such a manner as to fall into the water, and then floated towards the site of the dam or dwellings. Small shrubs, &c. cut at a distance from the water, are dragged with their teeth to the stream, and then launched and towed to the place of deposit. At a short distance above a beaver-dam the number of trees which have been cut down appears truly surprising, and the regularity of the stumps which are left might lead persons unacquainted with the habits of the animal to believe that the clearing was the result of human industry.

The figure of the dam varies according to circumindividual, and unconnected with others of its kind, we shall find many more quadrupeds to exceed it in cunning, and almost all in the powers of annoyance and defence. The beaver, when taken from its fellows, and kept in a state of solitude or domestic tameness, appears to be a mild gentle creature, familiar enough, but somewhat dull, and even melan-

---

stances. Should the current be very gentle, the dam is carried nearly straight across; but when the stream is swiftly flowing, it is uniformly made with a considerable curve, having the convex part opposed to the current. Along with the trunks and branches of trees they intermingle mud and stones, to give greater security; and when dams have been long undisturbed and frequently repaired, they acquire great solidity, and their power of resisting the pressure of water and ice is greatly increased by the willow, birch, and other cuttings occasionally taking root, and eventually growing up into something of a regular hedge. The materials used in constructing the dams are secured solely by the resting of the branches, &c. against the bottom, and the subsequent accumulation of mud and stones, by the deposit of the stream or by the industry of the beavers.

The dwellings of the beaver are formed of the same materials as their dams, and are very rude, though strong, and adapted in size to the number of their inhabitants. These are seldom more than four old and six or eight young ones.

When building their houses, they place most of the wood crosswise and nearly horizontally, observing no other order than that of leaving a cavity in the middle. Branches which project inward are cut off with their teeth and thrown among the rest. The houses are by no means built of sticks first and then plastered, but all the materials, sticks, mud, and stones, if the latter can be procured, are mixed up together, and this composition is employed from the foundation to the summit. The mud is obtained from the adjacent banks or bottom of the stream or pond near the door of the hut. The beaver always carries mud and stones by holding them between his fore-paws and throat.

Their work is all performed at night, and with much expedition. When straw or grass is mingled with the mud used by them in building, it is an accidental circumstance, owing to the nature of the spot whence the mud was taken. As soon as any part of the material is placed where it is intended to remain, they turn round and give it a smart blow with the tail. The same sort of blow is struck by them upon the surface of the water when they are in the act of diving.

The outside of the hut is covered or plastered with mud late in the autumn, and after frost has begun to appear. By freezing it soon becomes almost as hard as stone, effectually excluding their great enemy, the wolverene, during the winter. Their habit of walking over the work frequently during its progress, has led to the absurd idea of their using the tail as a trowel. The habit of flapping with the tail is retained by them in a state of captivity, and, unless it be in the acts already mentioned, appears designed to effect no particular purpose. The houses, when they have stood for some time, and been kept in repair, become so firm from the consolidation of all the materials, as to require great exertion and the use of the ice-chisel, or other iron instruments, to be broken open. The laborious nature of such an undertaking may easily be conceived, when it is known that the tops of the houses are generally from four to six feet thick at the apex of the cone. Hearne relates having seen one instance in which the crown or roof of the hut was more than eight feet in thickness.

The door or hole leading into the beaver-hut is always on the side farthest from the land, and is near the foundation of the house, or at a considerable depth under water. This is the only opening into the hut, which is not divided into chambers.

All the beavers of a community do not co-operate in the fabrication of houses for the common use of the whole. Those who are to live together in the same hut, labour together in its construction, and the only affair in which all seem to have a joint interest, and upon which they labour in concert, is the dam, as this is designed to keep a sufficient depth of water around all the habitations.

In situations where the beaver is frequently disturbed and pursued, all its singular habits are relinquished, and its mode of living changed to suit the nature of circumstances, and this occurs even in different parts of the same rivers. Instead of building dams and houses, its only residence is then in the banks of the stream, where it is now forced to make a more extensive excavation, and be content to adopt the manners of a musk-rat. More sagacity is displayed by the beaver in thus accommodating itself to circumstances, than in any other action it performs. Such is the caution which it exercises to guard against detection, that were it not for the removal of small trees, the stumps of which indicate the sort of animal by which they have been cut down, the presence of the beaver would not be suspected in the vicinity. All excursions for the sake of procuring food are made late at night, and if it pass from one hole to another during the day time, it swims so far under water as not to excite the least suspicion of the presence of such a voyager. On many parts of the Mississippi and Missouri, where the beaver formerly built houses according to the mode above described, no such works are at present to be found, although beavers are still to be trapped in those localities.

These animals also have excavations in the adjacent banks, at rather regular distances from each other, which have been called *washes*. These excavations are so enlarged within, that the beaver can raise his head above water in order to breathe without being seen, and when disturbed at their huts, they immediately make way under water to these washes.

The beaver feeds principally upon the bark of the aspen, willow, birch, poplar, and occasionally the alder, but it rarely resorts to the pine tribe, unless from severe necessity. They provide a stock of wood from the trees mentioned, during the summer season, and place it in the water opposite the entrance to their houses. They also depend in a great degree upon the large roots (of the *nuphar luteum*) which grow at the bottom of the lakes, ponds, and rivers, and may be procured at all seasons.

The number of young produced by the beaver at a litter is from two to five. The young beavers whine in such a manner as closely to imitate the cry of a child. Like the young of most other animals they are very playful, and their movements are peculiarly interesting, as may be seen by the following anecdote, related in the narrative of Capt. Franklin's perilous journey to the shores of the Arctic Sea:—"One day a gentleman, long resident in the Hudson's Bay country, espied five young beavers sporting in the water, leaping upon the trunk of a tree, pushing one another off, and playing a thousand interesting tricks. He approached softly, under cover of the bushes, and prepared to fire on the unsuspecting creatures, but a nearer approach discovered to him such a similitude betwixt their gestures and the infantile caresses of his own children, that he threw aside his gun and left them unmolested."

The beaver swims to considerable distances under water, but cannot remain for a long time without coming to the surface for air. They are therefore caught with greater ease, as they must either take refuge in their choly; without any violent passions or vehement appetites, moving but seldom, making no efforts to attain any good, except in gnawing the wall of its prison, in order to regain its freedom; yet this, however, without anger or precipitation, but calm and indifferent to all about, without attachment or antipathies, neither seeking to offend nor desiring to please. It appears inferior to the dog in those qualities which render animals of service to man; it seems made neither to serve, to command, nor to have connections with any other set of beings, and is only adapted for living among its kind. Its talents are entirely repressed in solitude, and are only brought out by society. When alone, it has but little industry, few tricks, and without cunning sufficient to guard it against the most obvious and bungling snares laid for it by the hunter. Far from attacking any other animal, it is scarcely possessed of the arts of defence. Preferring flight to combat, like all wild animals, it only resists when driven to an extremity, and fights only when its speed can no longer avail.

But this animal is rather more remarkable for the singularity of its conformation, than any intellectual superiorities it may be supposed, in a state of solitude, to possess. The beaver is the only creature among quadrupeds that has a flat broad tail, covered with scales, which serves as a rudder to direct its motions in the water. It is the sole quadruped that has membranes between the toes on the hind feet only, and none on the fore feet, which supply the place of hands, as in the squirrel. In short, it is the only animal that in its fore parts entirely resembles a quadruped, and in its hinder parts seems to approach the nature of fishes, by having a scaly tail. In other respects, it is about two feet long, and near one foot high; it is somewhat shaped like a rat, except the tail, which, as has been observed, is flat and scaly, somewhat resembling a neat's tongue at the point. Its colour is of a light brown; the hair of two sorts; the one longer and coarser, the other soft, fine, short and silky. The teeth are like those of a rat or a squirrel, but longer and stronger, and ad-

---

vaults or washes in the bank, or seek their huts again for the sake of getting breath. They usually, when disturbed, fly from the huts to these vaults, which, although not so exposed to observation as their houses, are yet discovered with sufficient ease, and allow the occupant to be more readily captured than if he had remained in the ordinary habitation.

To capture beavers residing on a small river or creek, the Indians find it necessary to stake the stream across to prevent the animals from escaping, and then they try to ascertain where the vaults or washes in the banks are situated. This can only be done by those who are very experienced in such explorations. The hunt takes place in winter, because the animal's fur is then in the best order. The hunter is furnished with an ice-chisel lashed to a handle four or five feet in length; with this instrument he strikes against the ice as he goes along the edge of the banks. The sound produced by the blow informs him when he is opposite to one of these vaults. When one is discovered, a hole is cut through the ice of sufficient size to admit a full-grown beaver, and the search is continued until as many of the places of retreat are discovered as possible. During the time the most expert hunters are thus occupied, the others with the women are busy in breaking into the beaver-houses, which, as may be supposed from what has been already stated, is a task of some difficulty. The beavers, alarmed at the invasion of their dwelling, take to the water and swim with surprising swiftness to their retreats in the banks, but their entrance is betrayed to the hunters watching the holes in the ice, by the motion and discolouration of the water. The entrance is instantly closed with stakes of wood, and the beaver, instead of finding shelter in his cave, is made prisoner and destroyed. The hunter then pulls the animal out, if within reach, by the introduction of his hand and arm, or by a hook designed for this use, fastened to a long handle. Beaver-houses found in lakes or other standing waters offer an easier prey to the hunters, as there is no occasion for staking the water across.

The number of beavers killed in the northern parts of America is exceedingly great, even at the present time, after the fur trade has been carried on for so many years, and the most indiscriminate warfare waged uninterruptedly against the species. In the year 1820, sixty thousand beaver skins were sold by the Hudson's Bay Company alone. It is a subject of regret that an animal so valuable and prolific should be hunted in a manner tending so evidently to the extermination of the species, when a little care and management on the part of those interested might prevent unnecessary destruction, and increase the sources of their revenue. In a few years, comparatively speaking, the beaver has been exterminated in all the Atlantic and in the western estates, as far as the middle and upper waters of the Missouri; while in the Hudson's Bay possessions they are becoming annually more scarce, and the race will eventually be extinguished throughout the whole continent.

The Indians inhabiting the countries watered by the tributaries of the Missouri and Mississippi, take the beavers principally by trapping, and are generally supplied with steel traps by the traders, who do not sell, but lend or hire them, in order to keep the Indians dependent upon themselves, and also to lay claim to the furs which they may procure. The business of trapping requires great experience and caution, as the senses of the beaver are very keen, and enable him to detect the recent presence of the hunter by the slightest traces. It is necessary that the hands should be washed clean before the trap is handled and baited, and that every precaution should be employed to elude the vigilance of the animal. The bait which is used to entice the beavers is prepared from the substance called castor (*castoreum*) obtained from the glandulous pouches of the male animal, which contain sometimes from two to three ounces.

During the winter season the beaver becomes very fat, and its flesh is esteemed by the hunters to be excellent food. But those occasionally caught in the summer are thin, and unfit for the table. They lead so wandering a life at this season, and are so much exhausted by the collection of materials for building, or the winter's stock of provision, as well as by suckling their young, as to be generally at that time in a very poor condition. Their fur during the summer is of little value, and it is only in winter that it is to be obtained in that state which renders it so desirable to the fur-traders.—*Abridged in the Penny Magazine from Godman's American Natural History.*

mirably adapted to cutting timber or stripping bark, to which purposes they are constantly applied. One singularity more may be mentioned in its conformation; which is, that, like birds, it has but one and the same vent for the emission of its excrements and its urine; a strange peculiarity, but which anatomists leave us no room to doubt of.

The beavers begin to assemble about the months of June and July, to form a society that is to continue for the greatest part of the year. They arrive in numbers from every side, and generally form a company of above two hundred. The place of meeting is commonly the place where they fix their abode, and this is always by the side of some lake or river. If it be a lake, in which the waters are always upon a level, they dispense with building a dam; but if it be a running stream, which is subject to floods and falls, they then set about building a dam, or pier, that crosses the river, so that it forms a dead water in that part which lies above and below. This dam, or pier, is often fourscore or a hundred feet long, and ten or twelve feet thick at the base. If we compare the greatness of the work with the powers of the architect, it will appear enormous; but the solidity with which it is built is still more astonishing than its size. The part of the river over which this dam is usually built, is where it is most shallow, and where some great tree is found growing by the side of the stream. This they pitch upon as proper for making the principal part in their building: and, although it is often thicker than a man's body, they instantly set about cutting it down. For this operation they have no other instrument but their teeth, which soon lay it level, and that also on the side they wish it to fall, which is always across the stream. They then fall about cutting off the top branches, to make it lie close and even, and serve as the principal beam of their fabric.[1]

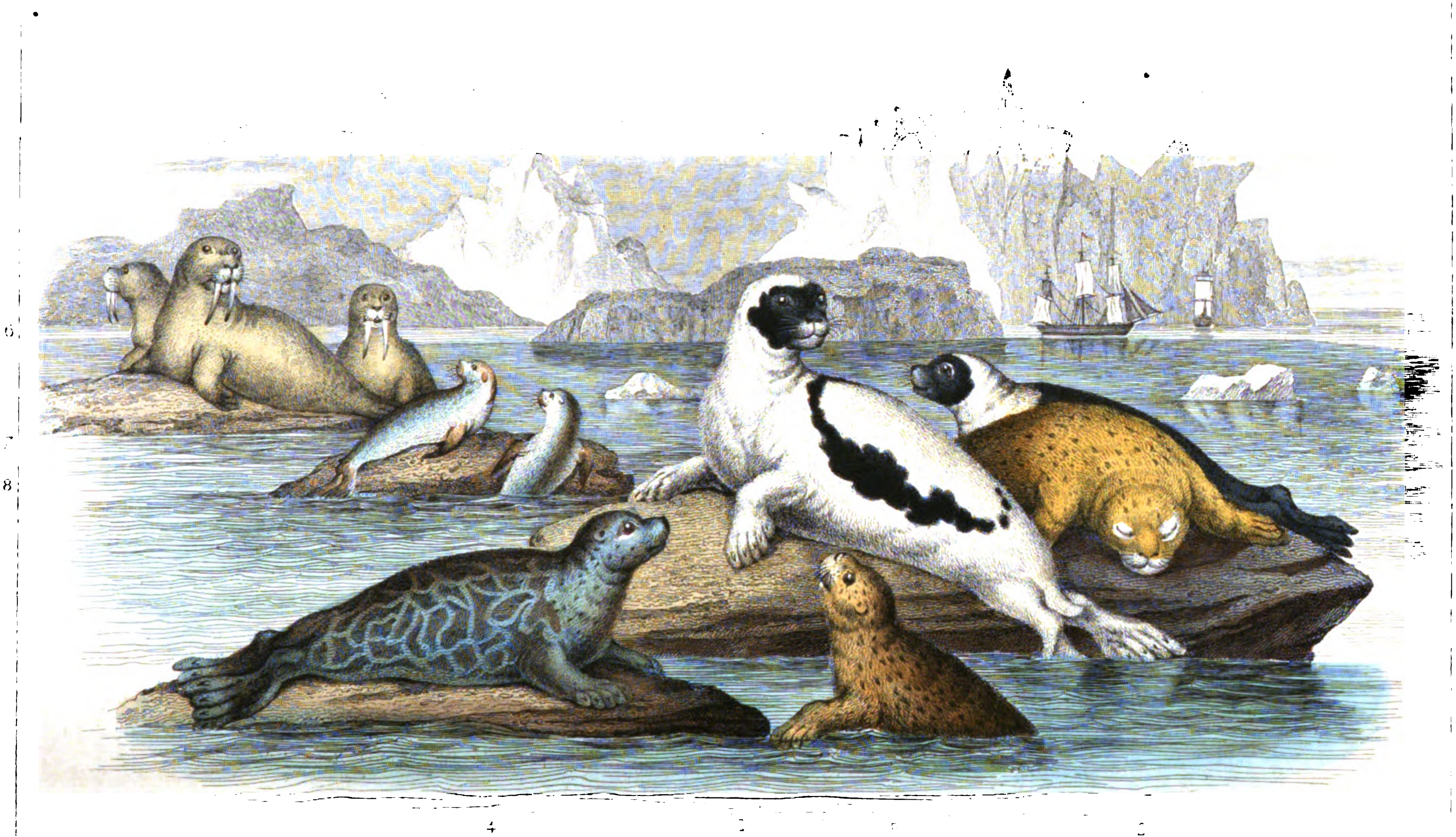
This dike, or causey, is sometimes ten, and sometimes twelve feet thick, at the foundation. It descends in a declivity, or slope, on that side next the water, which gravitates upon the work in proportion to the height, and presses it with a prodigious force towards the earth. The opposite side is erected perpendicular, like our walls; and that declivity, which, at the bottom, or basis, is about twelve feet broad, diminishes towards the top, where it is no more than two feet broad, or thereabouts. The materials whereof this mole consists, are wood and clay. The beavers cut, with surprising ease, large pieces of wood, some as thick as one's arm or thigh, and about four, five, or six feet in length, or sometimes more, according as the slope ascends. They drive one end of these stakes into the ground, at a small distance one from the other, intermingling a few with them that are smaller and more pliant. As the water, however, would find a passage through the intervals or spaces between them, and leave the reservoir dry, they have recourse to a clay, which they know where to find, and with which they stop up all the cavities both within and without, so that the water is duly confined. They continue to raise the dike in proportion to the elevation of the water, and the plenty which they have of it. They are conscious, likewise, that the conveyance of their materials by land would not be so easily accomplished as by water; and therefore they take the advantage of its increase, and swim with their mortar on their tails, and their stakes between their teeth, to the place where there is most occasion for them. If their works are, either by the force of the water, or, the feet of the huntsmen who run over them, in the least damnified, the breach is instantly made up; every nook and corner of the habitation is reviewed, and, with the utmost diligence and application, perfectly repaired. But when they find the huntsmen visit them too often, they work only in the night-time, or else abandon their works entirely, and seek out for some safer situation.

The dike or mole, being thus completed, their next care is to erect their several apartments: which are either round or oval, and divided into three stories, one raised above the other: the first below the level of the causey, which is for the most part full of water: the other two above it. This little fabric is built in a very firm and substantial manner on the edge of their reservoir, and always in such divisions or apartments as above mentioned; that in case of the water's increase, they may move up a story higher, and be no ways incommoded. If they find any little island contiguous to their reservoir, they fix their mansion there, which is then more solid, and not so frequently exposed to the overflowing of the water, in which they are not able to continue for any length of time. In case they cannot pitch upon so commodious a situation, they drive piles into the earth, in order to fence and fortify their habitation against the wind as well as the water. They make two apertures, at the bottom, to the stream; one is a passage to their bagnio, which they always keep neat and clean; the other leads to that part of the building where every thing is conveyed that will either soil or damage their upper apartments. They have a third opening, or doorway, much higher, contrived for the prevention of their being shut up and confined, when the frost and snow has closed the apertures of the lower floors. Sometimes they

---

[1] Spectacle de la Nature.

PLATE 42.



J. Stewart Del.

J. Power Sc.

1. 2. HARP SEAL (MALE AND FEMALE) 3. PENNANTS PIED SEAL. 4. MARBLED SEAL. 5. COMMON SEAL OF THE SCOTCH COASTS.
6. WALRUS OR SEA HORSE. 7. 8. FUR SEAL OF COMMERCE.

Blackie & Son, Glasgow, Edinburgh & London.

build their houses altogether upon dry land; but then they sink trenches five or six feet deep, in order to descend into the water when they see convenient. They make use of the same materials; and are equally industrious in the erection of their lodges, as their dikes. Their walls are perpendicular, and about two feet thick. As their teeth are more serviceable than saws, they cut off all the wood that projects beyond the wall. After this, when they have mixed up some clay and dry grass together, they work it into a kind of mortar, with which, by the help of their tails, they plaster all their works, both within and without.

The inside is vaulted, and is large enough for the reception of eight or ten beavers. In case it rises in an oval figure, it is for the generality above twelve feet long, and eight or ten feet broad. If the number of inhabitants increase to fifteen, twenty, or thirty, the edifice is enlarged in proportion. I have been credibly informed, that four hundred beavers have been discovered to reside in one large mansion-house, divided into a vast number of apartments, that had a free communication one with another.

All these works, more especially in the northern parts, are finished in August, or September at farthest; at which time they begin to lay in their stores. During the summer they are perfect epicures; and regale themselves every day on the choicest fruits and plants the country affords. Their provisions, indeed, in the winter season, principally consist of the wood of the birch, the plane, and some few other trees, which they steep in water from time to time, in such quantities as are proportioned to the number of inhabitants. They cut down branches from three to ten feet in length. Those of the largest dimensions are conveyed to the magazines by a whole body of beavers; but the smallest by one only: each of them, however, takes a different way, and has his proper walk assigned him, in order that no one labourer should interrupt another in the prosecution of his work. Their wood-yards are larger or smaller in proportion to the number in the family; and according to the observation of some curious naturalists, the usual stock of timber, for the accommodation of ten beavers, consists of about thirty feet in a square surface, and ten in depth. These logs are not thrown up in one continued pile, but laid one across the other with intervals or small spaces between them in order to take out, with the greater facility, but just such a quantity as they shall want for their immediate consumption, and those parcels only, which lie at the bottom in the water and have been duly steeped. This timber is cut again into small particles, and conveyed to one of their largest lodges, where the whole family meet, to consume their respective dividends, which are made impartially, in even and equal portions. Sometimes they traverse the woods and regale their young with a more novel and elegant entertainment.

Such as are used to hunt these animals, know perfectly well that green wood is much more acceptable to them than that which is old and dry; for which reason they plant a considerable quantity of it round their lodgments; and as they come out to partake of it, they either catch them in snares, or take them by surprise. In the winter, when the frosts are very severe, they sometimes break a large hole in the ice; and when the beavers resort thither for the benefit of a little fresh air, they either kill them with their hatchets, or cover the opening with a large substantial net. After this, they undermine and subvert the whole fabric; whereupon the beavers, in hopes to make their escape in the usual way, fly with the utmost precipitation to the water; and plunging into the aperture, fall directly into the net and are inevitably taken.

THE SEAL.

(*See Plate XIII. fig.* 63.)

Every step we proceed in the description of amphibious quadrupeds, we make nearer advances to the tribe of fishes. We first observed the otter, with its feet webbed and formed for an aquatic life; we next saw the beaver with the hinder parts covered with scales, resembling those of fishes; and we now come to a class of animals in which the shape and habits of fishes still more apparently prevail, and whose internal conformation attaches them very closely to the water. The seal, in general, resembles a quadruped in some respects, and a fish in others. The head is round like that of a man; the nose broad like that of the otter; the teeth like those of a dog; the eyes large and sparkling; no external ears, but holes that serve for that purpose; the neck is well proportioned and of a moderate length; but the body thickest where the neck is joined to it. From thence the animal tapers down to the tail, growing all the way smaller like a fish. The whole body is covered with a thick bristly shining hair, which looks as if it were entirely rubbed over with oil; and thus far the quadruped prevails over the aquatic. But it is in the feet that this animal greatly differs from all the rest of the quadruped kind; for though furnished with the same number of bones with other quadrupeds, yet they are so stuck on the body and so covered with a membrane, that they more resemble fins than feet; and might be taken for such, did not the claws with which they are pointed show their proper analogy. In the fore feet or rather hands, all the arm and the cubit are hid under the skin, and nothing appears but the hand from the wrist downwards; so that if we imagine a child with its arms swathed down, and nothing appearing but its hands at each side of the body, towards the breast, we may have some idea of the formation of this animal in that part. These hands are covered in a thick skin, which serves like a fin for swimming; and are distinguished by five claws, which are long, black, and piercing. As to the hind feet, they are stretched out on each side of the short tail, covered with a hairy skin like the former, and both together, almost joining at the tail; the whole looks like the broad flat tail of a fish; and were it not for five claws which appear, might be considered as such. The dimensions of this animal are various, being found from four feet long to nine. They differ also in their colours; some being black, others spotted, some white, and many more yellow. It would therefore be almost endless to mention the varieties of this animal. Buffon describes three; and Krantz mentions five, all different from those described by the other. I might, were I fond of such honours, claim the merit of being a first describer myself; but, in fact, the varieties of this animal are so many, that were they all described, the catalogue would be as extensive as it would be useless and unentertaining.[1] It is sufficient to observe, that they agree in the general external characters already mentioned, and internally in two or three more, which are so remarkable as to deserve peculiar attention.

It has been often remarked, that all animals are sagacious in proportion to the size of their brain. It has, in support of this opinion, been alleged, that man, with respect to his bulk, has, of all others, the largest. In pursuance of this assumption, some erroneous speculations have been formed. But, were the size of the brain to determine the quantity of the understanding, the seal would, of all other animals, be the most sagacious; for it has, in proportion, the largest brain of any, even man himself not excepted. However, this animal is possessed of but very few advantages over other quadrupeds; and the size of its brain furnishes it with few powers that contribute to its wisdom or its preservation.

This animal differs also in the formation of its tongue from all other quadrupeds. It is forked or slit at the end, like that of serpents; but for what purpose it is thus singularly contrived, we are at a loss to know. We are much better informed with respect to a third singularity in its conformation, which is, that the *foramen ovale* in the heart is open. Those who are in the least acquainted with anatomy know, that the veins uniting bring their blood to the heart, which sends it into the lungs, and from thence it returns to the heart again to be distributed through the whole body.

---

[1] All the species of seal live in herds, or families, more or less numerous, along the shores of the sea, and are fond of sunning themselves, and of sleeping upon the beaches, rocks, or ice-banks. When they do this in situations in which they are apprehensive of danger, instinct, or perhaps we should say experience, has taught them to take the precaution to post a sentinel to give an alarm when he observes any thing to excite apprehension: besides which, the common seal, while thus reposing, raises its head at frequent intervals, and looks around to observe that all is safe within its range of vision. In situations where they rarely experience disturbance, they sleep very profoundly and are easily surprised. In Iceland, and perhaps elsewhere, the seal has also a useful friend in the great sea-gull. In that country, the sportsmen, who are usually well acquainted with the haunts of the seal, raise up little bulwarks to conceal their approach, or wait for them behind a rock; the gull, however, understands these approaches, and frequently baffles all the precautions of the hunter by flying over his head and screaming close to the seal. If the latter does not take the alarm, the bird strikes him on the head, and as soon as he slips into the water seems perfectly conscious that he is no longer in danger.

Fights sometimes occur between the different species, between different herds of the same species, and between some species and the bears. But seals are generally of a pacific disposition: they avoid man when it is in their power to do so; but, when they have no other resource, defend themselves with a great deal of courage. They are in general very tenacious of life, and survive wounds which would kill most animals; but they are, on the other hand, much more easily despatched by blows on the head than most other quadrupeds. The size of the animal varies exceedingly in the different species. The full-grown bottle-nose seal measures from eleven to eighteen feet in length, and from seven to eleven in circumference; the length of the morse is from fifteen to eighteen feet, and that of the common seal is only from four to six feet. The flesh of some species is held in considerable estimation, while that of others is scarcely eatable, even by sailors long confined to salt food.

Few quadrupeds are more extensively diffused, in the different species, than the seals. They in general seem to prefer cold climates, but there is scarcely any sea on the shores of which they are not found. The appearance of the common seal is quite familiar on the northern and western shores of Scotland. Though properly a marine animal, the seal is found in fresh water lakes, as those of Baikal, Ladoga, and Onega; but in such situations it is of an unusually small size, but so fat as to appear almost a shapeless mass. Seals, indeed, become in general very fat. Their oil, as well as their skins, are important objects of commerce. The oil is pure, and adapted to all the purposes for which whale oil is used; and the skins are extensively employed by trunk-makers, saddlers, hatters, and others. Expeditions are fitted out from Europe and the United States for the sole purpose of catching seals. The Americans, in particular, annually visit the South Seas in search of these quadrupeds. A "sealing" voyage, with them, sometimes lasts three or more years, and the crews are exposed to very great hardships: they are often left in detachments upon small desert islands for months, for the purpose of hunting the animals to greater advantage; and years have sometimes elapsed before they have been able to obtain a release.

[2] Although deficient in their organs of sense, and the

Animals, however, before they are born, make no use of their lungs; and therefore their blood, without entering their lungs, takes a shorter passage through the very partition of the heart, from one of its chambers to the other, thus passing from the veins directly into those vessels that drive it through the whole frame. But the moment the animal is brought forth, the passage through the partition, which passage is called the *foramen ovale*, closes up, and continues closed for ever; for the blood then takes its longest course through the lungs to return to the other chamber of the heart again. Now the seal's heart resembles that of an infant in the womb, for the *foramen ovale* never closes;[1] and although the blood of this animal commonly circulates through the lungs, yet it can circulate without their assistance, as was observed above, by a shorter way. From hence, therefore, we see the manner in which this animal is adapted for continuing under water; for, being under no immediate necessity of breathing, the vital motions are still carried on while it continues at the bottom: so that it can pursue its prey in that element, and yet enjoy all the delights and advantages of ours.

The water is the seal's usual habitation, and whatever fish it can catch its food. Though not equal in instinct and cunning to some terrestrial animals, it is greatly superior to the mute tenants of that element in which it chiefly resides. Although it can continue for several minutes under water, yet it is not able, like fishes, to remain there for any length of time; and a seal may be drowned, like any other terrestrial animal. Thus it seems superior, in some respects, to the inhabitants of both elements, and inferior in many more. Although furnished with legs, it is, in some measure, deprived of all the advantages of them.[2] They are shut up within its body, while nothing appears but the extremities of them, and these furnished with very little motion, but to serve them as fins in the water. The hind feet, indeed, being turned backwards, are entirely useless upon land; so that when the animal is obliged to move, it drags itself forward like a reptile, and with an effort more painful. For this purpose it is obliged to use its fore-feet, which though very short, serve to give it such a degree of swiftness that a man cannot readily overtake it; and it runs towards the sea. As it is thus awkwardly formed for going upon land, it is seldom found at any distance from the sea-shore, but continues to bask upon the rocks; and when disturbed always plunges down at once to the bottom.

The seal is a social animal, and wherever it frequents, numbers are generally seen together. They are found in every climate, but in the north and icy seas they are particularly numerous. It is on those shores, which are less inhabited than ours, and where the

---

general formation of their members, seals display unusual sagacity, which goes to prove the influence of the brain in all that is intellectual. Of three seals in the French menagerie, upon which M. F. Cuvier made observations, none of them experienced fear in the presence of man, or any other animal. Nothing ever induced them to fly, except approaching so near as to excite in them the apprehension of being trodden under foot, and even in this case they only avoided the danger by removing to a little distance. One of them, indeed, would sometimes threaten with its voice, and strike with its paw; but it would never bite, except in the last extremity. In taking their food, they evinced a similar gentleness of character. Though very voracious, they could behold it withdrawn from them without fear or resistance. They would suffer the fish which had been just given them to be taken away with impunity, and some young dogs, to which one of those seals was attached, would amuse themselves in snatching the fish from his mouth which he was just ready to swallow, without his testifying the least anger. When two seals, however, were allowed to eat together, the usual result was a combat carried on with their paws, which ended by the weakest or most timid leaving the field in possession of his antagonist.

With the exception of some species of the monkey, there is scarcely any wild animal more easily tamed than the seal, or capable of a stronger degree of attachment. One of the individuals before-mentioned, showed, at first, some degree of shyness, and fled at the show of caresses: but, in a few days, his fear was totally at an end. He soon discovered the nature and intent of such movements, and his confidence became unbounded. This same phoca was shut up with two little dogs, who used to mount upon his back, bark at, and seemed to bite him; and although sports of this kind were at variance with his habits and nature, he soon learned to appreciate their motive, and to take pleasure in them. He never replied to them, but by gentle strokes of his paw, which seemed rather intended to excite than to repress them. If the dogs escaped he would follow them, though walking over ground covered with stones and mud must have been a painful effort to him; and when cold weather came, he and the dogs would lie closely together, to keep each other warm.

Another was peculiarly attached to the person who had the care of him; he soon learned to know this person at any distance within his range of vision. He would hold his eyes fixed upon him while he was present, and run forward the moment he saw him approach. Hunger, to be sure, entered for something into the affection he testified towards his keepers. The continual attention which he paid to every motion connected with the gratification of his appetite had made him remark, at the distance of sixty paces, the place which contained his food, although it was devoted to several other uses, and though it was entered but twice a day for the purpose of procuring his nutriment. If he was at liberty when his keeper approached to feed him, he would run forward, and solicit his food by lively motions of his head and the most expressive glances of his eye. This animal exhibited many other instances of considerable intelligence

[1] I have followed the usual observations of naturalists with respect to the *foramen ovale* in this animal: I have many reasons, however, to incline me to think that the *foramen* is not entirely open. But this is not the place for a critical inquiry of this kind.—*Goldsmith.*

[2] Buffon.

fish resort in greater abundance, that they are seen by thousands, like flocks of sheep, basking on the rocks, and suckling their young. There they keep watch like other gregarious animals; and, if an enemy appear, instantly plunge all together into the water. In fine weather they more usually employ their time in fishing; and generally come on shore in tempests and storms. The seal seems the only animal that takes delight in these tremendous conflicts of nature. In the midst of thunders and torrents, when every other creature takes refuge from the fury of the elements, the seals are seen by thousands sporting along the shore, and delighted with the universal disorder! This, however, may arise from the sea being at that time too turbulent for them to reside in; and they may then particularly come upon land when unable to resist the shock of their more usual element.

As seals are gregarious, so are they also animals of passage, and perhaps the only quadrupeds that migrate from one part of the world to another. The generality of quadrupeds are contented with their native plains and forests, and seldom stray except when necessity or fear impels them. But seals change their habitation, and are seen in vast multitudes directing their course from one continent to another.[1] On the northern coasts of Greenland they are seen to retire in July, and to return again in September. This time it is supposed they go in pursuit of food. But they make a second departure in March, to cast their young, and return in the beginning of June, young and all, in a great body together, observing in their route a certain fixed time and track, like birds of passage. When they go upon this expedition, they are seen in great droves, for many days together, making towards the north, taking that part of the sea most free from ice, and going still forward into those seas where man cannot follow. In what manner they return, or by what passage, is utterly unknown; it is only observed, that when they leave the coasts to go upon this expedition, they are all extremely fat, but on their return they come home excessively lean.[2]

The females, in our climate, bring forth in winter, and rear their young upon some sandbank, rock, or desolate island, at some distance from the continent. When they suckle their young, they sit up on their hinder-legs while these, which are at first white, with woolly hair, cling to the teats, of which there are four in number, near the navel.[1] In this manner the young continue in the place where they are brought forth, for twelve or fifteen days; after which the dam brings them down to the water, and accustoms them to swim and get their food by their own industry. As each litter never exceeds above three or four, so the animal's cares are not much divided, and the education of her little ones is soon completed. In fact, the young are particularly docile; they understand the mother's voice among the numerous bleatings of the rest of the old ones; they mutually assist each other in danger, and are perfectly obedient to her call. Thus early accustomed to subjection, they continue to live in society, hunt and herd together, and have a variety of tones by which they encourage to pursue, or warn each other of danger. Some compare their voices to the bleating of a flock of sheep, interrupted now and then by the barking of angry dogs, and sometimes the shriller notes of a cat. All along the shore, each has its own peculiar rock, of which it takes possession, and where it sleeps when fatigued with fishing, uninterrupted by any of the rest. The only season when their social spirit seems to forsake them, is that when they feel the influences of natural desire. They then fight most desperately, and the male that is victorious keeps all the females to himself. Their combats, on these occasions, are managed with great obstinacy, and yet great justice: two are never seen to fall upon one together; but each has its antagonist, and all fight an equal battle, till one alone becomes victorious.

---

[1] Krantz, vol. i. p. 129.

[2] The Greenlanders have three ways of taking seals; either singly with the bladder, or in company by the *clapper-hunt*, or in the winter on the ice; to which peculiar methods that of shooting may now be added.

When the Greenlander, properly equipped for hunting, observes the harp seal, he endeavours to surprise it unawares, and approaches with the wind and sun in his back that he may not be seen or heard by it. When he comes within four, five, or six fathoms of the animal, all his implements being in previous readiness, he transfers the oar to his left hand, and taking the harpoon (to which an inflated bladder is attached by a long string) in his right, launches it with all his force against the seal. The moment the animal is pierced, the man throws the bladder, tied to the end of the string, into the water, on the same side that the seal runs and dives, which it instantly does like a dart. The seal often drags the bladder under water; but, from its size, it is so great an impediment, that the animal soon tires, and must come up again in about a quarter of an hour to take breath. The man hastens to the spot where he sees the bladder ascend, and as soon as the seal appears, throws an unbarbed lance against it. This lance always comes out of the wound it has inflicted, and the man continues to employ it until the seal is quite exhausted, when he runs a smaller lance into it, and kills it outright; but he immediately after closes the wound in order to preserve the blood.

Of the several species of seal found in Greenland, only one, the harp seal, called by the natives *attarsoak*, which is the most stupid and careless, can be caught in this manner. Several other species, more careful or timid, are taken by several men in company, in what Crantz calls the "clapper-hunt." In this process the men cut off their retreat, and frighten them under water by clapping, shouting, and throwing stones; but as the seals must come to the surface at frequent intervals to draw breath, the men again persecute them, until at last the animals are obliged to remain so long under water, that when they do come up, they stay so long at the surface as to afford the men an easy opportunity of effecting their destruction.

The third method of killing seals (upon the ice) is mostly practised in Disko, where the bays are frozen over in the winter. Several methods of proceeding are adopted. The seals themselves sometimes make holes in the ice, at which they come to breathe. Near such a hole the Greenlander seats himself upon a stool, resting his feet on one that is lower to keep them from the cold: he thus sits watching; and when the animal comes and puts its nose to the hole, he pierces it instantly with his harpoon; and then, breaking the hole larger, he draws it out and kills it quite. Another method is for a man to lie along upon his belly, on a kind of sledge near other holes from which the seals come out occasionally upon the ice to bask themselves in the sun. Near this great opening another small one is made, at which another man is stationed who holds, inserted through it, a harpoon with an unusually long shaft or pole. The man who lies upon the ice looks into the large hole until he perceives a seal under the harpoon; he then makes a signal to the other man, who instantly thrusts down the weapon with all his strength, to run the animal through.

If a Greenlander happens to see a seal near its hole upon the ice, he slides along upon his belly towards it, wagging his head and imitating the grunting of a seal, so that the poor animal, concluding it to be one of its own harmless companions, allows the man to come near enough to pierce it with his long dart.

When the current wears a large opening in the ice in spring, the Greenlanders station themselves all around it, waiting till the seals come in large droves thither to take breath, when they kill them with their harpoons. Many also are killed on the ice while they lie sleeping and snoring in the sun.

An interesting account of the habits of the seal, as observed in the Orkney and Shetland Islands, is given in the 'Fauna Orcadensis' of the Rev. George Low, minister of Birsa and Haray, from which we extract the following particulars.

We are not certainly informed how long the females continue pregnant; but if we may judge from the time which intervenes between their departure from the Greenland coasts and

---

Seals are very numerous in these parts, especially in the desert isles or sea-rocks that are separated from the land: there they lie in droves when the sea is low, and in season bring forth their young.

The seal swims with great rapidity, and, before a gale of wind, is full of frolic, jumping and tumbling about, sometimes throwing itself entirely out of the water, and performing many awkward gambols, at last retiring to its wonted rock or cavern, and there remaining till the storm is over. Seals seem to have much curiosity. If people are passing in boats they often come up very close, stare at them, and follow them a considerable time. If the people are speaking loud, they seem to pay much attention, and to exhibit some surprise. The church of Hoy, in Orkney, is situated near a small sandy bay, which is much frequented by these animals; and Mr Low used to observe that when the bell rung for divine service, all the seals within hearing would swim directly for the shore, and would remain while the bells continued ringing, looking about with much appearance of wonder, but without alarm.

Numbers of seals are yearly caught upon the northern coasts, both with nets and shot, for the sake chiefly of the skins and oil. Mr Low was credibly informed that in North Ronaldsha they were taken also for eating, and that very good hams were made from them. He had seen large numbers of seals cut up, and had no doubt that the young ones might eat tolerably well; but the flesh of the old ones is coarse-grained and black, and must be very indifferent food. We are not so much surprised as Mr Low that the people of Ronaldsha should eat seals. He was probably aware, from Pennant, that seals formerly found a place at the tables of the great even in England, as appears from the bill of fare of the famous feast given by Archbishop Neville in the reign of Edward IV., which states that several were provided on that occasion.

Mr Low also informs us that in his time (he died in 1795) a ship went annually from Pomona (as we understand him) to Soliskerry, and seldom returned without 200 or 300 seals. She was manned with between thirty and forty men, who, as soon as they came up with the rock, landed,—except a few who remained on board to receive what the others killed,—and immediately surrounded the seals which were then on it. One party, armed with clubs, commenced knocking them on the head, and another employed itself in *jacking*, that is, cutting off the skin with the blubber on it, while another party put the produce on board. They continued this as long as any seals remained; and when their task was accomplished, they hastened on board and set sail, as they were in danger from the weather while they remained, as, if it blew up, it was impossible for them to get to their boats. When they returned home, the "jacks" were divided, and sold by public auction, producing five or six shillings each; and each man generally got about thirty shillings for his share, after allowing a third for the vessel, and something more than a common share for the master. When the "jacks" were sold, the blubber was cut from the skin and boiled down into oil, which sold well. The skins were fastened to the walls of the houses till dry, and were then sold to the trunk-makers and others for eight-pence or a shilling a-piece, small and great. Mr Low adds that the local tanners dressed the seal-skin both for shoes and breeches, but they did not answer very well for the former, being soft and spongy, but, when properly managed, they did well for breeches. They were also dressed, with the hair on, for saddle-covers; and very beautiful skins are sometimes made into waistcoats.

The following species of seals are figured in the *coloured Plate* 42.

Figs. 1 and 2. THE HARP SEAL (*Phoca Groenlandica*), is about six feet in length, and is remarkable for changing its colour in its advance to maturity.

Fig. 3. PENNANT'S PIED SEAL (*Phoca Bicolor*). This species takes its name from its diversity of colour.

Fig. 4. MARBLED SEAL (*Phoca discolor*). An inhabitant of the Northern Seas, which takes its popular name from the singular variegations of its body.

Fig. 5. COMMON SEAL of the Scotch coasts (*Phoca vitulina*). It is said to inhabit the Caspian Sea, and the large lakes of fresh water in Russia and Siberia. This Seal becomes white in old age. It is very common on our coasts.

Fig. 6. WALRUS OR SEA-HORSE (*Trichecus Linnæus*). The walrus is a genus of the Phocidæ or Seal family, but differs from them in the cranium and teeth. Its canine tusks are directed downwards, and are sometimes two feet long. It feeds on shell-fish and marine vegetables. It was formerly abundant in the Norwegian Seas, but is now driven further north. It appears to be monogamous, and the female is said to produce, whether on shore or on the ice, only one at a birth. The flesh is highly valued by the inhabitants of the Arctic regions, and our own northern voyagers have often found it an acceptable repast.

Fig. 7. THE FUR SEAL of commerce (*Otaria Falklandica*). An inhabitant of the Falkland Isles.

[1] Coeunt in littore resupinata femina.—*Lin. Syst.*

their return, they cannot go above seven or eight months at the farthest. How long this animal lives is also unknown: a gentleman, whom I knew in Ireland, kept two of them, which he had taken very young, in his house for ten years; and they appeared to have the marks of age at the time I saw them, for they were grown gray about the muzzle; and it is very probable they did not live many years longer. In their natural state the old ones are seen very fat and torpid, separated from the rest, and, as it should seem, incapable of procreation.

As their chief food is fish, so they are very expert at pursuing and catching it. In those places where the herrings are seen in shoals, the seals frequent and destroy them by thousands. When the herring retires, the seal is then obliged to hunt after fish that are stronger and more capable of evading the pursuit: however, they are very swift in deep waters, dive with great rapidity, and, while the spectator eyes the spot at which they disappear, they are seen to emerge at above a hundred yards distance. The weaker fishes, therefore, have no other means to escape their tyranny, but by darting into the shallows. The seal has been seen to pursue a mullet, which is a swift swimmer, and to turn it to and fro in deep water, as a hound does a hare on land. The mullet has been seen trying every art of evasion; and at last swimming into shallow water, in hopes of escaping. There, however, the seal followed; so that the little animal had no other way left to escape, but to throw itself on one side, by which means it darted into shoaler water than it could have swam in with the belly undermost; and thus at last it got free.

As they are thus the tyrants of the element in which they chiefly reside, so they are not very fearful even upon land, except on those shores which are thickly inhabited, and from whence they have been frequently pursued. Along the desert coasts, where they are seldom interrupted by man, they seem to be very bold and courageous; if attacked with stones, like dogs, they bite such as are thrown against them; if encountered more closely, they make a desperate resistance, and, while they have any life, attempt to annoy their enemy. Some have been known, even while they were skinning, to turn round and seize their butchers; but they are generally despatched by a stunning blow on the nose. They usually sleep soundly when not frequently disturbed; and that is the time when the hunters surprise them. The Europeans who go into the Greenland seas upon the whale fishery, surround them with nets, and knock them on the head; but the Greenlanders, who are unprovided with so expensive an apparatus, destroy them in a different manner. One of these little men paddles away in his boat, and when he sees a seal asleep on the side of a rock, darts his lance, and that with such unerring aim, that it never fails to bury its point in the animal's side. The seal, feeling itself wounded, instantly plunges from the top of the rock, lance and all, into the sea, and dives to the bottom; but the lance has a bladder tied to one end, which keeps buoyant, and resists the animal's descent; so that every time the seal rises to the top of the water the Greenlander strikes it with his oar, until he at last despatches it. But, in our climate, the seals are much more wary, and seldom suffer the hunters to come near them. They are often seen upon the rocks of the Cornish coast, basking in the sun, or upon the inaccessible cliffs left dry by the tide. There they continue, extremely watchful, and never sleep long without moving; seldom longer than a minute; for then they raise their heads, and if they see no danger, they lie down again, raising and reclining their heads alternately, at intervals of about a minute each. The only method, therefore, that can be taken, is to shoot them: if they chance to escape, they hasten towards the deep, flinging stones and dirt behind them as they scramble along, and at the same time expressing their pain, or their fears, by the most distressful cry; if they happen to be overtaken, they make a vigorous resistance with their feet and teeth, till they are killed.

The seal is taken for the sake of its skin, and for the oil its fat yields. The former sells for about four shillings; and, when dressed, is very useful in covering trunks, making waistcoats, shot-pouches, and several other conveniences. The flesh of this animal formerly found place at the tables of the great. At a feast provided by Archbishop Neville, for Edward the Fourth, there were twelve seals and porpoises provided, among other extraordinary rarities.

As a variety of this animal, we may mention the SEA-LION, described in Anson's Voyages. This is much larger than any of the former; being from eleven to eighteen feet long. It is so fat, that when the skin is taken off, the blubber lies a foot thick all round the body. It seems to differ from the ordinary seal, not only in its size, but also in its food; for it is often seen to graze along the shore, and to feed upon the long grass that grows up along the edges of brooks. Its cry is very various, sometimes resembling the neighing of a horse, and sometimes the grunting of a hog. It may be regarded as the largest of the seal family.

THE MORSE.

The morse is an animal of the seal kind; but differing from the rest, in a very particular formation of the teeth, having two large tusks growing from the upper jaw, shaped like those of an elephant, but directed downwards; whereas, in the elephant, they grow upright, like horns; it also wants the cutting teeth, both above and below: as to the rest, it pretty much resembles a seal, except that it is much larger, being from twelve to sixteen feet long. The morses are also generally seen to frequent the same places that seals are known to reside in; they have the same habitudes, the same advantages, and the same imperfections. There are, however, fewer varieties of the morse than the seal; and they are rarely found, except in the frozen regions near the pole. They were formerly more numerous than at present; and the savage natives of the coasts of Greenland destroyed them in much greater quantities, before those seas were visited by European ships upon the whale-fishery, than now. Whether these animals have been since actually thinned by the fishers, or have removed to some more distant and unfrequented shores, is not known; but certain it is, that the Greenlanders, who once had plenty, are now obliged to toil more assiduously for subsistence; and as the quantity of their provisions decrease, for they live mostly upon seals, the numbers of that poor people are every day diminishing. As to the teeth, they are generally from two to three feet long; and the ivory is much more esteemed than that of the elephant, being whiter and harder. The fishers have been known formerly to kill three or four hundred at once; and along those shores where they chiefly frequented, their bones are still seen lying in prodigious quantities. In this manner a supply of provisions, which would have supported the Greenland nation for ages, has been, in a few years, sacrificed to those who did not use them, but who sought them, for the purposes of avarice and luxury!

THE MANATI.

We come, in the last place, to an animal that terminates the boundary between quadrupeds and fishes. Instead of a creature preying among the deeps, and retiring upon land for repose or refreshment, we have here an animal that never leaves the water, and is enabled to live only there. It cannot be called a quadruped, as it has but two legs only; nor can it be called a fish, as it is covered with hair. In short, it forms the link that unites those two great tribes to each other; and may be indiscriminately called the last of beasts, or the first of fishes.

We have seen the seal approaching nearly to the aquatic tribes, by having its hind legs thrown back on each side of the tail, and forming something that resembled the tail of a fish; but upon examining the skeleton of that animal, its title to the rank of a quadruped was observed plainly to appear, having all the bones of the hinder legs and feet as complete as any other animal whatsoever

But we are now come to a creature that not only wants the external appearance of hinder legs, but, when examined internally, will be found to want them altogether. The Manati is somewhat shaped in the head and the body like a seal; it has also the fore legs or hands pretty much in the same manner, short and webbed, but with four claws only; these also are shorter in proportion than in the former animal, and placed nearer the head; so that it can scarcely assist its motions upon land. But it is in the hinder parts that it chiefly differs from all others of the seal kind; for the tail is perfectly that of a fish, being spread out broad like a fan, and wanting even the vestiges of those bones which make the legs and feet in others of its kind. The largest of these are about twenty-six feet in length; the skin is blackish, very tough and hard; when cut as black as ebony; and there are a few hairs scattered, like bristles, of about an inch long. The eyes are very small, in proportion to the animal's head; and the ear-holes, for it has no external ears, are so narrow as scarcely to admit a pin's head. The tongue is so short, that some have pretended it has none at all; and the teeth are composed only of two solid white bones, running the whole length of both jaws, and formed merely for chewing, and not tearing its vegetable food. The female has breasts placed forward, like those of a woman; and she brings forth but one at a time: this she holds with her paws to her bosom; there it sticks, and accompanies her wherever she goes.

This animal can scarcely be called amphibious, as it never entirely leaves the water, only advancing the head out of the stream to reach the grass on the river sides. Its food is entirely upon vegetables; and, therefore, it is never found far in the open sea, but chiefly in the large rivers of South America; and often above two thousand miles from the ocean. It is also found in the seas near Kamschatka, and feeds upon the weeds that grow near the shore. There are likewise level greens at the bottom of some of the Indian bays, and there the manaties are harmlessly seen grazing among turtles and other crustaceous fishes, neither giving nor fearing any disturbance. These animals, when unmolested, keep together in large companies, and surround their young ones.[1] They bring forth most commonly in autumn; and it is supposed they go with young eighteen months, for the time of generation is in spring.

The manati has no voice nor cry, for the only noise it makes is by fetching its breath. Its internal parts somewhat resemble those of a horse; its intestines being longer, in proportion, than those of any other creature, the horse only excepted.

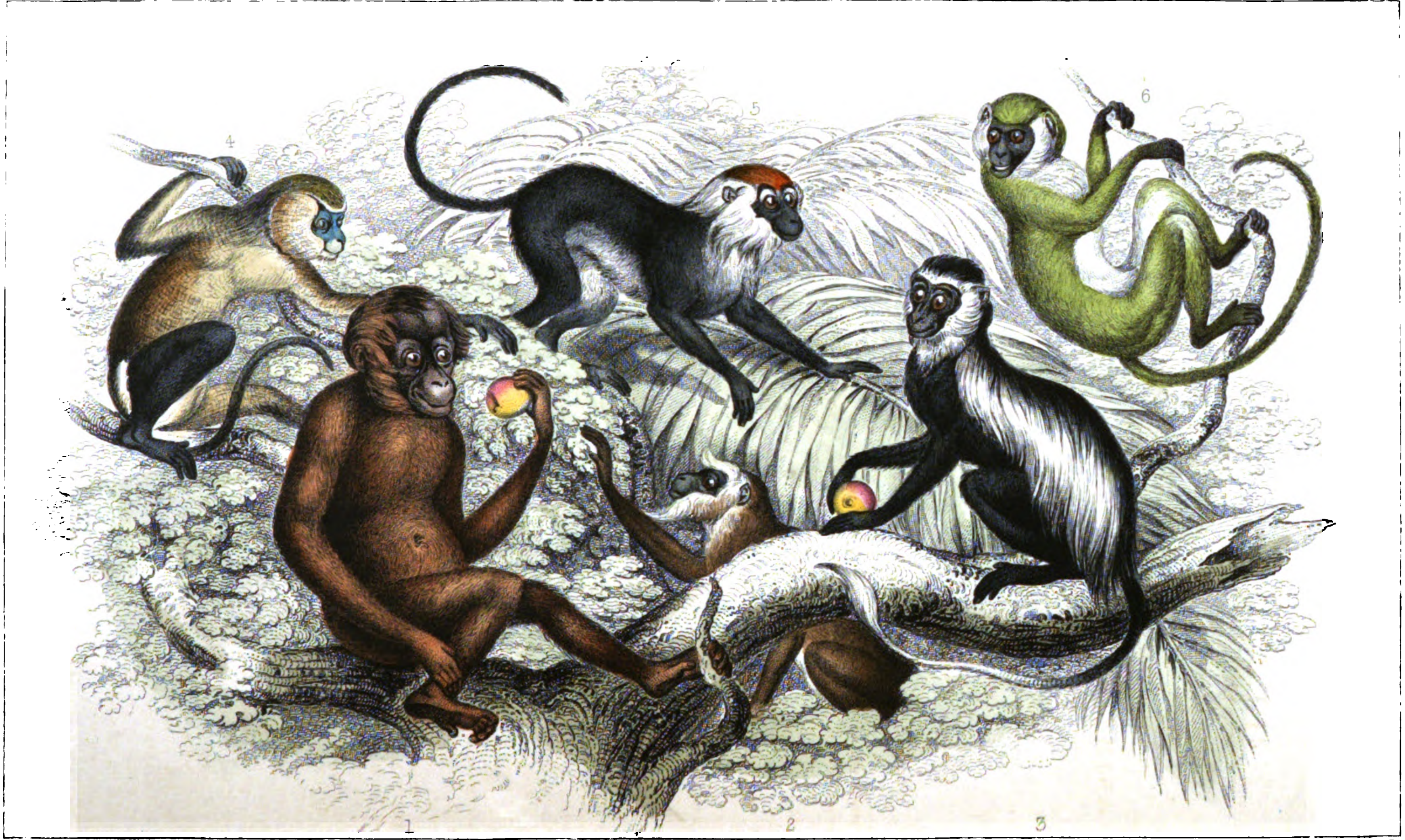
The fat of the manati, which lies under the skin, when exposed to the sun, has a fine smell and taste, and far exceeds the fat of any sea animal; it has this peculiar property, that the heat of the sun will not spoil it, nor make it grow rancid; its taste is like the oil of sweet almonds; and it will serve very well, in all cases, instead of butter: any quantity may be taken inwardly with safety, for it has no other effect than keeping the body open. The fat of the tail is of a harder consistence; and, when boiled, is more delicate than the former. The lean is like beef, but more red; and may be kept a long while, in the hottest days, without tainting. It takes up a long time in boiling; and, when done, eats like beef. The fat of the young ones is like pork; the lean is like veal; and, upon the whole, it is very probable that this animal's flesh somewhat resembles that of turtle; since they are fed in the same element, and upon the very same food. The turtle is a delicacy well known among us: our luxuries are not as yet sufficiently heightened to introduce the manati; which, if it could be brought over, might singly suffice for a whole corporation![2]

---

[1] Acta Petropolitana.

[2] Among amphibious animals may be classed the Ornithorhynchus or the duck-billed Platypus, a creature discovered in Australia, which seems to be compounded of the quadruped and the bird. This singular animal, which lays eggs and hatches them, and yet suckles its young, we shall describe, along with the kangaroo, in the concluding chapter on quadrupeds.

PLATE 43



J. Stewart Del. T. Brown Sc.

1 RED ORANG-OUTANG 2. DIANA MONKEY. 3. GUEREZA MONKEY. 4. VARIED MONKEY.

5. COLLARED WHITE-EYELID MONKEY. 6. GREEN MONKEY

Blackie & Son Glasgow Edinburgh & London

A

HISTORY OF ANIMALS.

BOOK VII.

ANIMALS OF THE MONKEY KIND—THE ELEPHANT, RHINOCEROS, ETC.

CHAP. I.

ANIMALS OF THE MONKEY KIND.[1]

Quadrupeds may be considered as a numerous group, terminated on every side by some that but in part deserve the name. On one quarter we see a tribe covered with quills, or furnished with wings, that lift them among the inhabitants of the air; on another, we behold a diversity clothed with scales and shells, to rank with insects; and still on a third, we see

---

[1] Monkeys form by far the greatest portion of the Quadrumana; all the other animals of that order being comprehended, or rather confounded, in a distinct family under the name of Lemurs, from the rightful owners of which appellation many of them differ most essentially. In addition to the hands on the posterior as well as anterior members, with long and flexible fingers and opposable thumbs, which constitute the primary characters of the order, the monkey tribe in general is distinguished by the following peculiarities. Their incisor teeth are invariably four in each jaw, and their molars, like those of man, are flat and surmounted by blunted tubercles. The latter are five in number on each side of either jaw, in all the monkeys of the Old Continent, and in one very distinct tribe belonging to the New; but most of the American species are furnished with a sixth. Their canines vary considerably in size, from a trifling projection beyond the remaining teeth to a long and powerful tusk, almost equalling those of the most formidable carnivora; and from this structure it necessarily follows that a vacant space is left between the incisors and the canines of the upper jaw, and between the canines and the molars of the lower, for the reception and lodgment of those organs when the mouth is closed. The nails of all their fingers, as well as those of the thumbs, are invariably flat and expanded.

In almost every other point they are subject to infinite variations of form and structure. The shape of the head, which, in one or two species, offers a close approximation to the human form, passes through numerous intermediate gradations, until it reaches a point at which it can only be compared with that of the hound. The body, which is in general slight and well made, is in some few instances remarkably short and thickset, and in others drawn out to a surprising degree of tenuity. Their limbs vary greatly in their proportions; but in most of them the anterior are longer than the posterior: in all they are admirably adapted to the purposes to which they are applied, in climbing and leaping by the slenderness of their form, the flexibility of their joints, and the muscular activity with which these qualities are so strikingly combined. But of all their organs there is perhaps none which exhibits so remarkable a discrepancy in every particular as the tail; which is entirely wanting in some, forms a mere tubercle in others, in a third group is short and tapering, in a fourth of moderate length and cylindrical, in a fifth extremely long, but uniformly covered with hair; in others, again, of equal length, divested of hair beneath and near the tip, and capable of being twisted round the branch of a tree or any other similar substance in such a manner as to support the whole weight of the animal, even without the assistance of his hands.

In none of them, it may be observed, are the hands formed for swimming, or the nails constructed for digging the earth; and in none of them is the naked callous portion, which corresponds to the sole or the palm, capable of being applied, like the feet of man or of the bear, to the flat surfaces on which they may occasionally tread. Even in those which have the greatest propensity to assume an upright posture, the body is, under such circumstances, wholly supported by the outer margins of the posterior hands. The earth, in fact, is not their proper place of abode; they are essentially inhabitants of trees, and every part of their organization is admirably fitted for the mode of life to which they were destined by the hand of nature herself. Throughout the vast forests of Asia, Africa, and South America, and more especially in those portions of the three continents which are comprehended within the tropics, they congregate in numerous troops, bounding rapidly from branch to branch, and from tree to tree, in search of the fruits and eggs which constitute their principal means of subsistence. In the course of these peregrinations, which are frequently executed with a velocity scarcely to be followed by the eye, they seem to give a momentary, and but a momentary, attention to every remarkable object that falls in their way, but never appear to remember it again; for they will examine the same object with the same rapidity as often as it recurs, and apparently without in the least recognizing it as that which they had seen before. They pass on a sudden from a state of seeming tranquillity to the most violent demonstrations of passion and sensuality; and in the course of a few minutes run through all the various phases of gesture and action of which they are capable, and for which their them descending into the waters, to live among the mute tenants of that element. We now come to a numerous tribe, that leaving the brute creation, seem to make approaches even to humanity; that bear an awkward resemblance of the human form, and discover some faint efforts at intellectual sagacity.

Animals of the Monkey class are furnished with hands instead of paws; their ears, eyes, eye-lids, lips, and breasts, are like those of mankind; their internal conformation also bears some distant likeness; and the whole offers a picture that may well mortify the pride of such as make their persons alone the principal object of their admiration. These approaches, however, are gradual; and some bear the marks of this our boasted form more strongly than others.

In the Ape kind we see the whole external machine strongly impressed with the human likeness, and capable of the same exertions: these walk upright, want a tail, have fleshy posteriors, have calves to their legs, and feet nearly like ours.

In the Baboon kind we perceive a more distant approach to the human form; the quadruped mixing in every part of the animal's figure: these generally go upon all fours; but some, when upright, are as tall as a man; they have short tails, long snouts, and are possessed of brutal fierceness.

The Monkey kind are removed a step further; these are much less than the former, with tails as long, or longer, than their bodies, and flatish faces.

Lastly, the Maki and Oppossum kind, seem to lose all resemblance of the human figure, except in having hands; their noses are lengthened out like those of quadrupeds, and every part of their bodies totally different

---

peculiar conformation affords ample scope. The females treat their young with the greatest tenderness until they become capable of shifting for themselves; when they turn them loose upon the world, and conduct themselves towards them from that time forwards in the same manner as towards the most perfect strangers.

The degrees of their so much vaunted intelligence, which is in general very limited, and rarely capable of being made subservient to the purposes of man, vary almost as much as the ever-changing outline of their form. From the grave and reflective oran-outang, whose docility and powers of imitation in his young state have been the theme of so much ridiculous exaggeration and sophistical argumentation, to the stupid and savage baboon, whose gross brutality is scarcely relieved by a single spark of intelligence, the gradations are regular and easy. A remarkable circumstance connected with the developement of this faculty, or perhaps we should rather say, with its gradual extinction, consists in the fact that it is only in young animals which have not yet attained their full growth, that it is capable of being brought into play; the older individuals, even of the most tractable races, entirely losing the gaiety, and with it the docility, of their youth, and becoming at length as stupid and as savage as the most barbarous of the tribe.

The monkeys of the Old and of the New World differ from each other in several remarkable points, some of which are universally characteristic of all the species of each, while others, although affording good and tangible means of discrimination, are but partially applicable. Thus the nostrils of all the species inhabiting the Old World are anterior, like those of man, and divided only by a narrow septum. In those of the New World, on the contrary, they are invariably separated by a broad division, and consequently occupy a position more or less lateral. In the former, again, the molar teeth are uniformly five in number, crowned with obtuse and flattened tubercles; while in the latter, they are either six in number, or in the few anomalous cases in which they are limited to five, and which are peculiar to a group that ought to occupy an intermediate station between the monkeys and the insect-eating carnivora, their crowns are surmounted by sharp and somewhat elevated points. The tails of all the American monkeys are of great length, but they differ more or less from each other in the power of suspending themselves by means of that organ, a faculty which is nevertheless common to the greater number of them, and of which those of the Old World are entirely destitute. On the other hand, the American species never exhibit any traces of the callosities or of the cheek-pouches, which are so common among the Asiatic and African races.

Each of these grand divisions has been subdivided into several minor groups or genera; but zoologists have hitherto been by no means unanimous with respect to the principles on which this subdivision ought to be effected. The arrangement which appears to be most generally adopted at the present day is that of M. Cuvier and M. Geoffroy-Saint-Hilaire, which is essentially founded on the application of an imaginary rule, first employed by Camper for ascertaining the degree of intelligence, and consequently of ideal beauty, expressed by the human face in its various gradations of elevation or debasement, and called by him the facial angle. Unfortunately, however, the operations of nature in the animal creation can never be subjected to geometrical laws; nor can her innumerable phases be expressed with the precision of a mathematical theorem. This assumed point of comparison varies almost indefinitely not merely in different species, but even in the same individual; and the oran-outang himself, who is supposed to approach most nearly to the human form, offers the most striking illustration of the truth of this observation; inasmuch as in his young and intellectual state his facial angle is equal to 65°, while in his aged and debased condition, in which he has actually been repeatedly described as a different animal under the name of Pongo, it sinks below 30°; degrading him even beneath the level of the most savage and stupid of the baboons.

In the foregoing observations we may be perhaps considered as giving too much space to the generalities of the subject; an objection to which we can only answer that nearly the whole of our knowledge of the monkey tribes consists in generalities. Of the great number of species, upwards of one hundred which are now known and characterized, very few are distinguished from their immediate fellows by striking and strongly-marked characters, either physical or moral. The groups too are connected by such gradual and easy transitions, that the entire series offers a chain so nearly complete and unbroken as scarcely to admit of being treated of in any other way than as one homogeneous whole. Some of the more interesting species will be found represented in the plates. Full-bottomed monkey, Plate XI. fig. 40. Proboscis monkey, Plate XIII. fig. 44. Varied monkey, Plate XII. fig. 5. Other species are described and referred to in the course of this chapter and notes.

from the human; however, as they grasp their food, or other objects, with one hand, which quadrupeds cannot do, this single similitude gives them an air of sagacity, to which they have scarcely any other pretensions.

From this slight survey it may be easily seen that one general description will not serve for animals so very different from each other: nevertheless, it will be fatiguing to the last degree, as their varieties are so numerous, and their differences so small, to go through a particular description of each. In this case it will be best to give a history of the foremost in each class; at the same time marking the distinctions in every species. By this we shall avoid a tedious repetition of similar characters, and consider the manners and the oddities of this fantastic tribe in general points of view; where we shall perceive how nearly they approach to the human figure, and how little they benefit by the approximation. The foremost of the ape kind is

THE ORAN-OUTANG, OR WILD MAN OF THE WOODS.

(*See Plate XII. fig.* 2.)

This name seems to have been given to various animals, agreeing in one common character of walking upright, but coming from different countries, and of very different proportions and powers. The TROGLODYTE of Bontius, the DRILL of Purchas, and the PIGMY of Tyson, have all received this general name: and have been ranked, by some naturalists, under one general description.[1] If we read the accounts of many remote travellers, under this name we are presented with a formidable animal, from six to eight feet high; if we examine the books of such as have described it nearer home, we find it a pigmy not above three. In this diversity we must be content to blend their various descriptions into one general account; observing, at the same time, that we have no reason to doubt any of their relations, although we are puzzled which to follow.

The oran-outang, which of all other animals most nearly approaches to the human race, is seen of different sizes, from three to seven feet high. In general, however, its stature is less than that of a man; but its strength and agility much greater. Travellers, who have seen various kinds of these animals in their native solitudes, give us surprising relations of their force, their swiftness, their address, and their ferocity. Naturalists, who have observed their form and manners at home, have been as much struck with their patient, pliant, imitative dispositions; with their appearance and conformation, so nearly human. Of the smallest sort of these animals we have had several, at different times, brought into this country, all nearly alike: but that observed by Dr Tyson is the best known, having been described with the greatest exactness.[2]

---

[1] The Troglodyte, or Chimpanse, (see Plate XII. fig. 1.) is a distinct animal from the oran-outang. The chimpanse seldom measure more than from two feet and a half to three feet in height; and its hair is dark brown, or blackish. Its head is conic, the body brawny, the back and shoulders are hairy, and the rest of the body smooth.

Two chimpanses were sent from the forests of the Carnatic by a coasting vessel, as a present to the governor of Bombay. They, like the rest of the species, had many human actions, and seemed, by their melancholy, to have a rational sense of their captivity. They were scarcely two feet high, but walked erect, and very nearly resembled the human form. The female was taken ill during the voyage, and died; and the male, exhibiting every demonstration of grief, refused to eat, and lived only two days afterwards.

Both in face and form, the chimpanse has a closer approximation to humanity than the oran-outang. Its habitat is confined to intertropical Africa—that of the oran-outang is Asiatic.

[2] Naturalists are now inclined to suspect that what has hitherto been described in Europe as the oran-outang, is in fact, a young *pongo*—an ape of great strength and size. The most recent and most remarkable capture of the pongo or great oran-outang is recorded by Dr Clarke Abel, in the fifteenth volume of the Asiatic Researches.

Dr Clarke Abel's attention was originally directed to the subject by the following notice in the *Hurkara Newspaper*, communicated to that journal by one of the individuals concerned in the onslaught.

"A party having landed on the north coast of Sumatra, from the Mary-Anne Sophia, Captain Cornfoot, for the purpose of watering, fell in with an animal of the monkey species of a most gigantic size. It was upwards of seven feet in height; and, after receiving seven shots, was killed. After the fifth shot, it climbed a tree, and reclined against its boughs, to all appearance in great pain, and vomited a considerable quantity of blood. Its lower jaw, and the skin of the back and arms, which are brought round to Calcutta I have seen. Some of the teeth of the upper jaw have also arrived here, and are about to be deposited in the museum of the Asiatic Society. There are some of them about three inches long. The lower jaw is immense: and the skin, to which I have before referred, is so large, that, although cut off from the wrists, each arm is now considerably longer than mine, and I am a man not a quarter of an inch under six feet. The back is remarkably broad, and is covered with long coarse brown hair. When the animal made its appearance, it seemed as if it had come from some distance; and to all appearance it had been walking through a swamp, its legs, up to the knees, being muddy. Its gait was slovenly, and as it went it waddled from side to side."

Dr Abel adds the following additional information, obtained through direct oral communication with Captain Cornfoot. "This formidable animal was more than a head taller than the tallest man on board, even in an ordinary standing posture, and it measured eight feet in height when suspended for the purpose of being skinned. The form and arrangement of its beard were beautiful; there was a great deal of the human expression in its countenance, and its piteous actions when wounded, and great tenacity of life, rendered the scene tragical and affecting. On the spot where he was killed, there were five or six tall trees which greatly prolonged the combat; for so great was his strength and agility in bound-

The animal which was described by that learned physician, was brought from Angola, in Africa, where it had been taken in the internal parts of the country, in company with a female of the same kind, that died by the way. The body was covered with hair, which was of a coal black colour, more resembling human hair than that of brutes. It bore a still stronger similitude in its different lengths; for in those places where it is longest on the human species it was also longest in this; as on the head, the upper lip, the chin, and the pubes. The face was like that of a man, the forehead larger, and the head round. The upper and lower jaw were not so prominent as in monkeys; but flat, like those of a man. The ears were like those of a man, in most respects; and the teeth had more resemblance to the human than those of any other creature. The bending of the arms and legs was just the same as in a man; and, in short, the animal, at first view, presented a figure entirely human.

In order to discover its differences, it was necessary to take a closer survey; and then the imperfections of its form began to appear. The first obvious difference was in the flatness of the nose; the next in the lowness of the forehead, and the wanting the prominence of the chin. The ears were proportionably too large; the eyes too close to each other; and the interval between the nose and mouth too great. The body and limbs differed, in the thighs being too short, and the arms too long; in the thumb being too little, and the palm of the hand too narrow. The feet also were rather more like hands than feet; and the animal, if we may judge from the figure, bent too much upon its haunches.

When this creature was examined anatomically, a surprising similitude was seen to prevail in its internal conformation. It differed from man in the number of its ribs, having thirteen; whereas, in man, there are but twelve. The vertebræ of the neck also were shorter, the bones of the pelvis narrower, the orbits of the eyes were deeper, the kidneys were rounder, the urinary and gall-bladders were longer and smaller, and the ureters of a different figure. Such were the principal distinctions between the internal parts of this animal and those of man; in almost every thing else they were entirely and exactly the same, and discovered an astonishing congruity. Indeed, many parts were so much alike in conformation that it might have excited wonder how they were productive of such few advantages. The tongue, and all the organs of the voice, were the same, and yet the animal was dumb; the brain was formed in the same manner with that of man, and yet the

---

ing from branch to branch, that his pursuers were unable to take a determinate aim, until they had felled all the trees but one. Even then he did not yield himself to his antagonists till he had received five balls, and been moreover thrust through with a spear. One of the first balls appears to have penetrated his lungs, for he was observed immediately to sling himself by his feet from a branch, with his head downwards, so as to allow the blood to flow from his mouth. On receiving a wound, he always put his hand over the injured part, and distressed his pursuers by the human-like agony of his expression. When on the ground, after being exhausted by his many wounds, he lay as if dead, with his head resting on his folded arms. It was at this moment that an officer attempted to give him the *coup-de-grace* by pushing a spear through his body, but he immediately jumped on his feet, wrested the weapon from his antagonist, and shivered it in pieces. This was his last wound, and his last great exertion; yet he lived some time afterwards, and drank, it is stated, great quantities of water. Captain Cornfoot also observes, that the animal had probably travelled some distance to the place where he was killed, as his legs were covered with mud up to the knees."

The countenance of this tremendous creature, with the exception of the beard, was nearly bare, a few short downy hairs being alone scattered over it. It was of a dark lead colour, excepting the margins of the lips, which were paler. The eyes were small, in relation to those of man, and about an inch apart. The eyelids were well fringed with lashes. The ears were comparatively very small, being not more than an inch and a half long, and barely an inch in breadth. They lay close to the head, and resembled those of the human race, with the exception of the lower lobe, which was wanting. The nose scarcely rose above the level of the face, and the nostrils were three-fourths of an inch in breadth, and were placed obliquely side by side. The muzzle was projecting, and the opening of the mouth very large. The lips appeared narrow when closed, but were, in reality, half an inch in thickness. The hair of the head was of a reddish brown colour; it grew from behind forwards, and measured five inches in length. The beard was handsome, and appeared to have been curly during the lifetime of the animal. Its colour was lighter than the hair of the head, and approached a light chestnut. The beard was about three inches long, and sprung very gracefully from the upper lip, near the angles of the mouth, in the form of mustachios, from whence descending, it clothed the chin.

The palms of the hands were of great length, and naked from the wrists. Their backs were covered with hair, which was sparse upon the fingers. This hair inclined backwards towards the wrists, and then turned directly upwards. All the fingers were terminated by strong, black, convex nails. The thumb reached to the first joint of the forefinger. The soles of the feet were bare; the feet were covered on the back with long brown hair, as far as the last joint of the toes. The great toe was set on nearly at right angles to the foot, and was relatively very short. The general colour of the skin of this animal was a dark lead. The hair was of a brownish red, varying in some places to a blackish hue, but appearing red under a stronger light. It was on all parts very long, directed upwards on the fore arm, but from the upper arm it hung down loose and shaggy. It was equally long and full upon the flanks, but was more scantily spread over the chest and fore part of the body. The extended arms of this woodland giant were capable of embracing a span of eight feet two inches. His height, according to the measurements of Dr Abel, may have exceeded, but could not have been less than seven feet six inches and a half.

creature wanted reason: an evident proof (as Mr Buffon finely observes) that no dispositions of matter will give mind; and that the body, how nicely soever formed, is formed in vain, when there is not infused a soul to direct its operations.

Having thus taken a comparative view of this creature with man, what follows may be necessary to complete the general description. This animal was very hairy all behind, from the head downwards; and the hair so thick that it covered the skin almost from being seen; but in all parts before, the hair was much thinner, the skin everywhere appeared, and in some places it was almost bare. When it went on all-fours, as it was sometimes seen to do, it appeared all hairy; when it went erect it appeared before less hairy, and more like a man. Its hair, which in this particular animal was black, much more resembled that of men than the fur of brutes; for, in the latter, besides their long hair, there is usually a finer and a shorter intermixed; but in the oran-outang it was all of a kind; only about the pubes the hair was grayish, seemed longer, and somewhat different; as also on the upper lip and chin, where it was greyish like the hair of a beard. The face, hands, and soles of the feet, were without hair; and so was most part of the forehead: but down the sides of the face the hair was thick, it being there about an inch and a half long, which exceeded that on any other part of the body. In the palms of its hands were remarkable those lines which are usually taken notice of in palmistry; and, at the tips of the fingers, those spiral lines observed in man. The palms of the hands were as long as the soles of the feet; and the toes upon these were as long as the fingers; the middle toe was the longest of all, and the whole foot differed from the human. The hinder feet being thus formed as hands, the animal often used them as such; and, on the contrary, now and then made use of its hands instead of feet. The breasts appeared small and shrivelled, but exactly like those of a man: the navel also appeared very fair, and in exact dispositions, being neither harder nor more prominent than what is usually seen in children. Such is the description of this extraordinary creature; to which little has been added by succeeding observers, except that the colour of the hair is often found to vary; in that described by Edwards it was of a reddish brown.

From a picture so like that of the human species, we are naturally led to expect a corresponding mind; and it is certain, that such of these animals as have been shown in Europe, have discovered a degree of imitation beyond what any quadruped can arrive at.

That of Tyson was a gentle, fond, harmless creature. In its passage to England, those that it knew on ship-board it would embrace with the greatest tenderness, opening their bosoms, and clasping its hands about them. Monkeys of a lower species it held in utter aversion; it would always avoid the place where they were kept in the same vessel; and seemed to consider itself as a creature of higher extraction. After it was taken, and a little used to wear clothes, it grew very fond of them; a part it would put on without any help, and the rest it would carry in its hands to some of the company, for their assistance. It would lie in a bed, place its head on the pillow, and pull the clothes upwards as a man would do.

That which was seen by Edwards, and described by Buffon, showed even a superior degree of sagacity. It walked, like all of its kind, upon two legs, even though it carried burdens. Its air was melancholy, and its deportment grave. Unlike the baboon or monkey, whose motions are violent, and appetites capricious, who are fond of mischief, and obedient only from fear, this animal was slow in its motions, and a look was sufficient to keep it in awe. I have seen it, says Mr Buffon, give its hand to show the company to the door: I have seen it sit at table, unfold its napkin, wipe its lips, make use of the spoon and the fork to carry the victuals to its mouth, pour out its drink into a glass, touch glasses when invited, take a cup and saucer and lay them on the table, put in sugar, pour out its tea, leave it to cool before drinking, and all this without any other instigation than the signs or the command of its master, and often of his own accord. It was gentle and inoffensive; it even approached strangers with respect, and came rather to receive caresses than to offer injuries. It was particularly fond of sugared comfits, which every body was ready to give it; and as it had a defluxion upon the breast, so much sugar contributed to increase the disorder, and shorten its life. It continued at Paris but one summer, and died in London. It ate indiscriminately of all things, but it preferred dry and ripe fruits to all other aliments. It would drink wine, but in small quantities, and gladly left it for milk, tea, or any other sweet liquor.[1]

---

[1] Dr Clark Abel has given the following interesting account of the oran-outang which he brought from Java to England. "On board ship an attempt being made to secure him by a chain tied to a strong staple, he instantly unfastened it, and ran off with the chain dragging behind; but finding himself embarrassed by its length, he coiled it once or twice, and threw it over his shoulder. This feat he often repeated; and when he found that it would not remain on his shoulder, he took it into his mouth. After several abortive attempts to secure him more effectually, he was allowed to wander freely about the ship, and soon became familiar with the

Such these animals appeared when brought into Europe. However, many of their extraordinary habits were probably the result of education, and we are not told how long the instructions they received for this purpose were continued. But we learn from another account, that they take but a very short time to come to a great degree of imitative perfec-

---

sailors, and surpassed them in agility. They often chased him about the rigging, and gave him frequent opportunities of displaying his adroitness in managing an escape. On first starting, he would endeavour to outstrip his pursuers by mere speed; but when much pressed, eluded them by seizing a loose rope, and swinging out of their reach. At other times, he would patiently wait on the shrouds or at the mast-head, till his pursuers almost touched him, and then suddenly lower himself to the deck by any rope that was near him, or bound along the main-stay from one mast to the other, swinging by his hands, and moving them one over the other. The men would often shake the ropes by which he clung with so much violence, as to make me fear his falling; but I soon found that the power of his muscles could not be easily overcome. When in a playful humour, he would often swing within arm's length of his pursuer, and, having struck him with his hand, throw himself from him.

"Whilst in Java he lodged in a large tamarind-tree near my dwelling, and formed a bed by intertwining the small branches, and covering them with leaves. During the day, he would lie with his head projecting beyond his nest, watching whoever might pass under; and when he saw any one with fruit, would descend to obtain a share of it. He always retired for the night at sunset, or sooner, if he had been well fed, and rose with the sun, and visited those from whom he habitually received food.

"Of some small monkeys on board from Java he took little notice, whilst under the observation of the persons of the ship. Once, indeed, he openly attempted to throw a small cage, containing three of them, overboard; because, probably, he had seen them receive food, of which he could obtain no part. But although he held so little intercourse with them when under our inspection, I had reason to suspect, that he was less indifferent to their society when free from our observation; and was one day summoned to the top-gallant-yard of the mizen-mast to overlook him playing with a young male monkey. Lying on his back, partially covered with a sail, he for some time contemplated, with great gravity, the gambols of the monkey, which bounded over him: but at length caught him by the tail, and tried to envelope him in his covering. The monkey seemed to dislike his confinement, and broke from him, but again renewed its gambols, and although frequently caught, always escaped. The intercourse, however, did not seem to be that of equals, for the oran-outang never condescended to romp with the monkey, as he did with the boys of the ship. Yet the monkeys had evidently a great predilection for his company; for whenever they broke loose, they took their way to his resting-place, and were often seen lurking about it, or creeping clandestinely towards him. There appeared to be no gradation in their intimacy; as they appeared as confidently familiar with him when first observed, as at the close of their acquaintance.

"But although so gentle when not exceedingly irritated, the oran-outang could be excited to violent rage, which he expressed by opening his mouth, showing his teeth, and seizing and biting those who were near him. Sometimes, indeed, he seemed almost driven to desperation: and, on two or three occasions, committed an act, which, in a rational being, would have been called the threatening of suicide. If repeatedly refused an orange when he attempted to take it, he would shriek violently, and swing furiously about the ropes; then return and endeavour to obtain it; if again refused, he would roll for some time like an angry child upon the deck, uttering the most piercing screams; and then suddenly starting up, rush furiously over the side of the ship and disappear. On first witnessing this act, we thought that he had thrown himself into the sea; but, on a search being made, found him concealed under the chains.

"This animal neither practises the grimaces and antics of other monkeys, nor possesses their perpetual proneness to mischief. Gravity, approaching to melancholy, and mildness, were sometimes strongly expressed in his countenance, and seem to be the characteristics of his disposition. When he first came among strangers, he would sit for hours with his hand upon his head, looking pensively at all around him; and when much incommoded by their examination, would hide himself beneath any covering that was at hand. His mildness was evinced by his forbearance under injuries, which were grievous before he was excited to revenge; but he always avoided those who often teased him. He soon became strongly attached to those who kindly used him. By their side he was fond of sitting; and getting as close as possible to their persons, would take their hands between his lips, and fly to them for protection. From the boatswain of the Alceste, who shared his meals with him, and was his chief favourite, although he sometimes purloined the grog and the biscuit of his benefactor, he learned to eat with a spoon; and might be often seen sitting at his cabin door, enjoying his coffee, quite unembarrassed by those who observed him, and with a grotesque and sober air, that seemed a burlesque on human nature.

"Next to the boatswain, I was, perhaps, his most intimate acquaintance. He would always follow me to the mast-head, where I often went for the sake of reading apart from the noise of the ship; and, having satisfied himself that my pockets contained no eatables, would lie down by my side, and pulling a topsail entirely over him, peep from it occasionally to watch my movements.

"His favourite amusement in Java was in swinging from the branches of trees, in passing from one to another, and in climbing over the roofs of houses; on board, in hanging by his arms from the ropes, and in romping with the boys of the ship. He would entice them into play by striking them with his hand as they passed, and bounding from them, but allowing them to overtake him, and engage in a mock scuffle, in which he used his hands, feet, and mouth. If any conjecture could be formed from these frolics of his mode of attacking the adversary, it would appear to be his first object to throw him down, then to secure him with his hands and feet, and then wound him with his teeth.

"On board ship he commonly slept at the mast-head, after wrapping himself in a sail. In making his bed, he used the greatest pains to remove every thing out of his way, that might render the surface on which he intended to lie uneven: and, having satisfied himself with this part of his arrangement, spread out the sail, and lying down upon it on his back, drew it over his body. Sometimes I pre-occupied his bed, and teased him by refusing to give it up. On these occasions he would endeavour to pull the sail from under me, or to force me from it, and would not rest till I had resigned it. If it were large enough for both, he would quietly lie by my side. If all the sails happened to be set, he would hunt about for some other covering, and either steal one of the sailors' jackets or shirts that happened to tion. Mr L. Brosse bought two young ones, that were but a year old, from a negro; and these at that early age discovered an astonishing power of imitation.[1] They even then sat at the table like men, ate of every thing without distinction; made use of their knife, spoon, and fork, both to eat their meat and help themselves. They drank wine and other liquors. When carried on ship-board they had signs for the cabin-boys expressive of their wants; and whenever these neglected attending upon them as they desired, they instantly flew into a passion, seized them by the arm, bit them, and kept them down. The male was sea-sick, and required attendance like a human creature; he was twice bled in the arm, and every time afterwards, when he found himself out of order, he showed his arm, as desirous of being relieved by bleeding.

Pyrard relates, that in the province of Sierra Leone, in Africa, there are a kind of apes, called Baris, which are strong and muscular, and which, if properly instructed when young, serve as very useful domestics. They usually walk upright; they pound at a mortar; they go to the river to fetch water, this they carry back in a little pitcher on their heads; but if care be not taken to receive the pitcher at their return, they let it fall to the ground, and then seeing it broken, they begin to lament and cry for their loss. Le Compte's account is much to the same purpose, of an ape which he saw in the Straits of Molucca. "It walked upon its two hind feet, which are bent a little, like a dog that had been taught to dance. It made use of its hands and arms as we do. Its visage was not much more disagreeable than that of a Hottentot; but the body was all over covered with a woolly hair of different colours. As to the rest it cried

---

be drying, or empty a hammock of its blankets. Off the Cape of Good Hope he suffered much from a low temperature, especially early in the morning, when he would descend from the mast, shuddering with cold, and running up to any one of his friends, climb into their arms, and clasping them closely, derive warmth from their persons, screaming violently at any attempt to remove him.

"His food in Java was chiefly fruit, especially mangostans, of which he was extremely fond. He also sucked eggs with voracity, and often employed himself in seeking them. On board ship his diet was of no definite kind. He ate readily of all kinds of meat, and especially raw meat; was very fond of bread, but always preferred fruits, when he could obtain them.

"His beverage in Java was water; on board ship it was as diversified as his food. He preferred coffee and tea, but would readily take wine, and exemplified his attachment to spirits by stealing the captain's brandy bottle. Since his arrival in London he has preferred beer and milk to any thing else, but drinks wine and other liquors.

"In his attempts to obtain food, he afforded us many opportunities of judging of his sagacity and disposition. He was always very impatient to seize it when held out to him, and became passionate when it was not soon given up; and would chase a person all over the ship to obtain it. I seldom came upon deck without sweetmeats or fruit in my pocket, and could never escape his vigilant eye. Sometimes I endeavoured to evade him by ascending to the mast head, but was always overtaken or intercepted in my progress. When he came up with me on the shrouds, he would secure himself by one foot to the ratlings, and confine my legs with the other and one of his hands, while he rifled my pockets. If he found it impossible to overtake me, he would climb to a considerable height on the loose rigging, and then drop suddenly upon me. Or if, perceiving his intention, I attempted to descend, he would slide down a rope, and meet me at the bottom of the shrouds. Sometimes I fastened an orange to the end of a rope, and lowered it to the deck from the mast head; and as soon as he attempted to seize it drew it rapidly up. After being several times foiled in endeavouring to obtain it by direct means, he altered his plan. Appearing to care little about it, he would remove to some distance, and ascend the rigging very leisurely for some time, and then, by a sudden spring, catch the rope which held it. If defeated again by my suddenly jerking the rope, he would at first seem quite in despair, relinquish his effort, and rush about the rigging, screaming violently. But he would always return, and again seizing the rope, disregard the jerk, and allow it to run through his hand till within reach of the orange; but if again foiled, would come to my side, and taking me by the arm, confine it while he hauled the orange up.

"I have seen him exhibit violent alarm on two occasions only, when he appeared to seek for safety in gaining as high an elevation as possible. On seeing eight large turtles brought on board, whilst the Cæsar was off the Island of Ascension, he climbed with all possible speed to a higher part of the ship than he had ever before reached, and, looking down upon them, projected his long lips into the form of a hog's snout, uttering at the same time a sound, which might be described as between the croaking of a frog and the grunting of a pig. After some time he ventured to descend, but with great caution, peeping continually at the turtle, but could not be induced to approach within many yards of them. He ran to the same height, and uttered the same sounds, on seeing some men bathing and splashing in the sea; and since his arrival in England has shown nearly the same degree of fear at the sight of a live tortoise."

This animal survived his transportation to this country from August 1817, when he arrived, to the 1st April, 1819, during which interval he was in the custody of Mr Cross at Exeter Change, as much caressed for the gentleness of his disposition as he was noticed for his great rarity. There was no need of personal confinement, and little of restraint or coercion; to his keepers especially, and to those whom he knew by their frequent visits, he displayed a decided partiality. During his last illness, and at his death, his piteous appearance, which seemed to bespeak his entreaties to those about him for relief, did not fail to excite the feelings of all who witnessed them, an excitement evidently heightened by the recollection of human suffering under similar circumstances, which the sight of this animal so strongly brought to mind. He was shedding his teeth at the period of his death, which was probably promoted, if not caused by it. This was sufficient evidence of his nonage, and as he increased both in stature and general bulk during his residence here, this individual may be said to support the conjecture that the adult oran-outang is no other than the Pongo.

[1] As quoted by Buffon, vol. xxviii. p. 77

like a child; all its outward actions were so like the human, and the passions so lively and significant, that dumb men could scarcely better express their conceptions and desires. It had also that expression of passion or joy which we often see in children, stamping with its feet, and striking them against the ground, to show its spite, or when refused any thing it passionately longed for. Although these animals (continues he) are very big, for that I saw was four feet high, their nimbleness is incredible. It is a pleasure beyond expression to see them run up the tackling of a ship, where they sometimes play as if they had a knack of vaulting peculiar to themselves, or as if they had been paid, like our rope-dancers, to divert the company. Sometimes, suspended by one arm, they poise themselves, and then turn all of a sudden round about a rope, with as much quickness as a wheel, or a sling put into motion. Sometimes holding the rope successively with their long fingers, and, letting their whole body fall into the air, they run full speed from one end to the other, and come back again with the same swiftness. There is no posture but they imitate, nor motion but they perform, bending themselves like a bow, rolling like a bowl, hanging by the hands, feet, and teeth, according to the different fancies with which their capricious imagination supplies them. But what is still more amazing than all, is their agility to fling themselves from one rope to another, though at thirty, forty, and fifty feet distance."

Such are the habitudes and the powers of the smaller class of these extraordinary creatures; but we are presented with a very different picture in those of a larger stature and more muscular form. The little animals we have been describing, which are seldom found above four feet high, seem to partake of the nature of dwarfs among the human species, being gentle, assiduous, and playful, rather fitted to amuse than terrify. But the gigantic races of the oran-outang, seen and described by travellers, are truly formidable, and in the gloomy forests, where they are only found, seem to hold undisputed dominion. Many of these are as tall or taller than a man; active, strong, and intrepid; cunning, lascivious, and cruel. This redoubtable rival of mankind is found in many parts of Africa, in the East Indies, in Madagascar, and in Borneo.[1] In the last of these places the people of quality course him as we do the stag; and this sort of hunting is one of the favourite amusements of the king himself. This creature is extremely swift of foot, endowed with extraordinary strength, and runs with prodigious celerity. His skin is all hairy, his eyes sunk in his head, his countenance stern, his face tanned, and all his lineaments, though exactly human, harsh and blackened by the sun. In Africa this creature is even still more formidable. Battel calls him the *pongo*, and assures us that in all his proportions he resembles a man, except that he is much larger, even to a gigantic state. His face resembles that of a man, the eyes deep sunk in the head, the hair on each side extremely long, the visage naked and without hair, as also the ears and the hands. The body is lightly covered, and scarcely differing from that of a man, except that there are no calves to the legs. Still, however, the animal is seen to walk upon his hinder legs, and in an erect posture. He sleeps under trees, and builds himself a hut, which serves to protect him against the sun and the rains of the tropical climates, of which he is a native. He lives only upon fruits, and is no way carnivorous. He cannot speak, although furnished with a greater instinct than any other animal of the brute creation. When the negroes make a fire in the woods, this animal comes near and warms himself by the blaze. However, he has not skill enough to keep the flame alive by feeding it with fuel. They go together in companies, and if they happen to meet one of the human species remote from succour, they show him no mercy. They even attack the elephant, which they beat with their clubs, and oblige to leave that part of the forest which they claim as their own. It is impossible to take any of these dreadful creatures alive, for they are so strong that ten men would not be a match for but one of them. None of this kind, therefore, are taken except when very young, and these but rarely, when the female happens to leave them behind; for in general they keep clung to the breast, and adhere both with legs and arms. From the same traveller we learn, that when one of these animals dies, the rest cover the body with a quantity of leaves and branches. They sometimes also show mercy to the human kind. A negro boy, that was taken by one of these, and carried into the woods, continued there a whole year, without receiving any injury.[2] From another traveller we learn, that these animals often attempt to surprise the female negroes as they go into the woods, and frequently keep them against their wills for the pleasure of their company, feeding them very plentifully all the time. He assures us that he knew a woman of Loango that had lived among these animals for three years. They grow from six to seven feet high and are of unequalled strength. They build sheds, and make use of clubs for their defence. Their faces are broad, their noses flat, their ears without a tip, their skins are more bright than that of a mulatto, and they are covered on many parts of the body with long and tawny-coloured hair. Their belly is large, their heels flat, and yet rising behind. They sometimes walk upright, and sometimes upon all fours, when they are fantastically disposed.

---

[1] Le Compte's History of China.

[2] Le Brosse, as quoted by Buffon, vol. xxviii. p. 70.

From this description of the oran-outang, we perceive at what a distance the first animal of the brute creation is placed from the very lowest of the human species. Even in countries peopled with savages, this creature is considered as a beast; and in those very places where we might suppose the smallest difference between them and mankind, the inhabitants hold it in the greatest contempt and detestation. In Borneo, where this animal has been said to come to its greatest perfection, the natives hunt it in the same manner as they pursue the elephant or the lion, while its resemblance to the human form procures it neither pity nor protection. The gradations of Nature in the other parts of nature are minute and insensible; in the passage from quadrupeds to fishes we can scarcely tell where the quadruped ends and the fish begins; in the descent from beasts to insects we can hardly distinguish the steps of the progression; but in the ascent from brutes to man, the line is strongly drawn, well marked, and unpassable. It is in vain that the oran-outang resembles man in form, or imitates many of his actions; he still continues a wretched helpless creature, pent up in the most gloomy part of the forest, and, with regard to the provision for his own happiness, inferior even to the elephant or the beaver in sagacity. To us, indeed, this animal seems much wiser than it really is. As we have long been used to measure the sagacity of all actions by their similitude to our own, and not their fitness to the animal's way of living, we are pleased with the imitations of the ape, even though we know they are far from contributing to the convenience of its situation. An ape, or a quadruped, when under the trammels of human education, may be an admirable object for human curiosity, but is very little advanced by all its learning in the road to its own felicity. On the contrary, I have never seen any of these long-instructed animals that did not, by their melancholy air, appear sensible of the wretchedness of their situation. Its marks of seeming sagacity were merely relative to us, and not to the animal; and all its boasted wisdom was merely of our own making.

There is, in fact, another circumstance relative to this animal, which ought not to be concealed. I have many reasons to believe that the most perfect of the kind are prone, like the rest of the quadruped creation, and only owe their erect attitude to human education. Almost all the travellers who speak of them, mention their going sometimes upon all-fours, and sometimes erect. As their chief residence is among trees, they are without doubt usually seen erect while they are climbing; but it is more than probable that their efforts to escape upon the ground are by running upon the hands and feet together. Schouten, who mentions their education, tells us that they are taken in traps, and taught in the beginning to walk upon their hind legs; which certainly implies that in a state of nature they run upon all-fours. Add to this, that, when we examine the palms of their hands and the soles of their feet, we find both equally callous and beaten: a certain proof that both have been equally used. In those hot countries where the apes are known to reside, the soles of the negroes' feet, who go bare-foot, are covered with a skin above an inch thick; while their hands are as soft as those of a European. Did the apes walk in the same manner, the same exercise would have furnished them with similar advantages, which is not the case. Besides all this, I have been assured by a very credible traveller, that these animals naturally run in the woods upon all-fours; and when they are taken, their hands are tied behind them, to teach them to walk upright. This attitude they learn after some time; and, thus instructed, they are sent into Europe to astonish the speculative with their near approaches to humanity, while it is never considered how much is natural, and how much has been acquired in the savage schools of Benin and Angola.

The animal next to these, and to be placed in the same class, is the APE, properly so called, or the PITHEKOS of the ancients. This is much less than the former, being not above a foot and a half high, but walks erect, is without a tail, and is easily tamed.

Of this kind also is the GIBBON, so called by Buffon, or the LONG-ARMED APE, which is a very extraordinary and remarkable creature.[1]

---

[1] The gibbon, simia lar of Linnæus, is distinguished in common with the other gibbons by the enormous length of the interior extremities. The arms, when the animal stands erect, very nearly touch the ground. The eyes are large and deeply seated—the nose is flat—and the ears not unlike the human. There is a circle of gray hairs passing over the eyes, cheeks, and under the lower jaw, which completely surrounds the visage and gives a very singular appearance to the animal. The hair also on the backs of the hands and feet is gray, in all other parts of the animal it is black, as is also the skin. The gibbon has not been found exceeding four feet in height.

The disposition of this species is said to be gentle, its motions neither rude nor precipitate. It receives its food, which consists chiefly of roots, almonds, &c. with-

It is of different sizes, being from four feet to two feet high. It walks erect, is without tail, has a face resembling that of a man, with a circle of bushy hair all round the visage; its eyes are large, and sunk in its head; its face tanned, and its ears exactly proportioned. But that in which it chiefly differs from all others of the monkey tribe, is the extraordinary length of its arms, which, when the animal stands erect, are long enough to reach the ground; so that it can walk upon all-fours, and yet keep its erect posture at the same time. This animal, next to the oran-outang and the ape, most nearly resembles mankind, not only in form, but in gentle manners and tractable disposition. It is a native of the East Indies, and particularly found along the coasts of Coromandel.

The last of the ape kind is the CYNOCEPHALUS, or the MAGOT of Buffon.[1] This animal

---

out greediness and without impatience. It suffers much from cold and from a low temperature, and seldom survives long removal from its native country. The parts of the East Indies in which it is most commonly found, are the coasts of Coromandel, the peninsula of Malacca, and the Molucca islands. It is probable also, that the gibbon may be found in some of the less southern provinces of India, travellers having described an animal called Fefe, found on the frontiers of China, to which they attribute much of the characters peculiar to the simia lar.

The ash-coloured gibbon, or wou-wou, differs little from the simia lar, except in colour. The arms are also said to be longer, and the posterior callosities larger than those of the black gibbon.

There is also a species called the little gibbon, which is about one-third less than the great gibbon, but it has precisely the same form and proportions. The face is surrounded with gray hairs, forming altogether a circle different in shape from that of the larger species, as appears by the figure. The top or crown of the head is blacker than the body. It has a small beard and whiskers.

Another species of the long-armed apes, is the SIAMANG. (See Plate XII. fig. 9.) The general description of this gibbon accords with that of the others of this sub-division of the apes; it seems therefore only necessary to advert to those particulars wherein it differs from its congeners; the most prominent of these is probably, that the first and second fingers of the hinder extremities are united as far as the middle of the second phalanx; the colour is black all over, without the white circle about the face; it has two loose naked folds of skin on the throat, which are occasionally inflated. The hair is long and soft; but the face is without any, as are also the breasts of the female. The orbits of the eye are circular and remarkably prominent, and the canine teeth are long.

These animals are very common in Sumatra. They are generally found assembled in large troops, conducted, as it is said, by a chief, whom the Malays believe to be invulnerable. Thus assembled at sunrise and again at sunset, they vie with each other in making the most dreadful cries, perfectly stunning to those accustomed to them, and frightful in the highest degree to strangers. Their powers of voice are doubtless increased by the guttural cavity before alluded to, analogous to a similar apparatus found in the howling monkeys of America. At all other times they appear to be perfectly quiet, so long at least as they are undisturbed. Naturally slow and heavy, they seem to want courage for climbing and activity for leaping, so that when suddenly surprised, they may in general be taken with ease; but nature, while she has deprived them of the power of avoiding danger by quickness and address, has endowed them with a great degree of vigilance for their preservation, so that they are generally alive to danger long enough before it reaches them to enable them to effect their retreat. When on the ground, however, they fall an easy prey, overcome by fear and rendered apparently more incapable by conscious weakness; in this situation their ineffectual efforts to fly display their imperfections, for the body, too high and heavy for their short and slender thighs, inclines forward, and their disproportioned arms, acting like stilts, enable them to advance only by short and inefficient jumps.

Another species or variety is the ACTIVE GIBBON, which is distinguished from the preceding gibbon of Sumatra, in which island this also is found, by its greater degree of activity, particularly in a state of nature. It is nearly three feet in height; the face is naked, of a very dark blue colour, lightly tinted with brown in the female; the eyes are near each other, and sunken; and the muzzle is remarkably prominent. The nose is not so flat as that of the siamang, and the nostrils are large and open laterally. The chin is furnished with a few black hairs. The ears are nearly hidden by the long hair around them, and there is a white band round the upper part of the face. The colour of this species seems to vary in different individuals and sexes, and in the same individual at different periods; but brown, with various shades, appears the prevailing tint.

The active gibbon is not gregarious like the siamang, but is generally found only with its female. It springs from tree to tree with wonderful agility, and can therefore but seldom be taken alive. In captivity, however, it exhibits little or nothing of its active powers, and though much more lively than the siamang, is less so than the monkeys in general. Not given to the exciteless apathy of the siamang, it may be frightened and quieted again: it avoids danger, and courts caresses: is a considerable glutton, curious, familiar, and sometimes even gay.—*Supplement to the English edition of Cuvier's Animal Kingdom.*

[1] The magot or Barbary ape, placed by Cuvier at the head of the baboons, is an animal not without intelligence. It is to his intelligence that the magot owes the numberless torments inflicted upon him by the mountebanks and showmen. Excepting the orans and the gibbons, he is the only monkey of the Old Continent capable of receiving a certain degree of instruction. The others, stupid or ferocious, were incapable in a state of slavery of comprehending any thing; but they have the consequent advantage of preserving their repose, while the magot is constantly exposed to lose both his comfort and freedom. Notwithstanding this, the male magot only submits to the dominion of man in extreme youth, and when his active faculties have not yet acquired their complete force and developement. Arrived at adolescence he begins to be less tractable, and, in a short time, refuses submission of every kind. Good treatment and bad, are equally without effect upon him. Alike incapable of confidence and of fear, he evinces nothing but a savage love of independence, which appears to be his only want. The painful state into which this feeling throws him, especially when it is strongly excited by severity, soon plunges him into a melancholy which is speedily followed by consumption and death.

The magot is considered more properly to belong to the monkeys than the baboons, as the mere absence of a tail is insufficient to characterize the larger divisions of the monkey tribe. The same may be said of what is called the *black ape*, (see Plate XII. fig. 7.) a monkey of extremely rare occurrence.

wants a tail, like the former, although there is a small protuberance at that part, which yet is rather formed by the skin than the bone. It differs also in having a large callous red rump. The face is prominent, and approaches more to that of quadrupeds than of man. The body is covered with a brownish hair, and yellow on the belly. It is about three feet and a half, or four feet high, and is a native of most parts of Africa and the East. As it recedes from man in its form, so also it appears different in its dispositions, being sullen, vicious, and untractable.[1]

THE BABOON.

Descending from the more perfect of the monkey kinds, we come to the baboon and its varieties, a large, fierce, and formidable race, that, mixing the figure of the man and the quadruped in their conformation, seem to possess only the defects of both; the petulance of the one, and the ferocity of the other. These animals have a short tail; a prominent face, with canine teeth, larger than those of men; and callosities on the rump.[2] In man the physiognomy may deceive, and the figure of the body does not always lead to the qualities of the mind; but in animals we may always judge of their dispositions by their looks, and form a just conjecture of their internal habits from their external form. If we compare the nature of the ape and the baboon by this easy rule, we shall at once be led to pronounce that they greatly differ in their dispositions, and that the latter are infinitely more fierce, savage, and malicious, than the former. The oran-outang, that so nearly resembles man in its figure, approaches also nearest in the gentleness of its manners and the pliancy of its temper. The cynocephalus, that of all other apes is most unlike man in form, and approaches nearer the dog in face, resembles also the brute in nature, being wild, restless, and impelled by a fretful impetuosity. But the baboon, who is still more remote, and resembles man only in having hands, who, from having a tail, a prominent face, and sharp claws, approaches more nearly to the savage tribe, is every way fierce, malicious, ignorant, and untractable.

The BABOON, properly so called, is from three to four feet high, very strong built, with a thick body and limbs, and canine teeth, much longer than those of men. It has large callosities behind, which are quite naked and red. Its tail is crooked and thick, and about seven or eight inches long. Its snout, for it can hardly be called a face, is long and thick, and on each side of its cheeks it has a pouch, into which, when satiated with eating, it puts the remainder of its provisions. It is covered with long thick hair, of a reddish brown colour, and pretty uniform over the whole body. It walks more commonly upon all fours than upright, and its hands as well as its feet are armed with long sharp claws, instead of the broad round nails of the ape kind.[3]

An animal thus made for strength, and furnished with dangerous weapons, is found, in fact, to be one of the most formidable of the savage race in those countries where it is bred. It appears in its native woods to be impelled by two opposite passions; a hatred for the males of the human species, and a desire for women. Were we assured of these strange oppositions in its disposition from one testimony alone, the account might appear doubtful: but as it comes from a variety of the most credible witnesses, we cannot refuse our assent. From them, therefore, we learn, that these animals will often assail women in a body, and force them into the woods, where they keep them against their will and kill them when refractory. From the Chevalier Forbin we learn, that in Siam whole troops of these will often sally forth from their forests, and attack a village when they know the men are engaged in their rice harvest. They are on such occasions actuated as well by desire as by hunger; and not only plunder the houses of whatever provisions they can find, but endeavour to force the women. These, however, as the Chevalier humorously relates, not at all liking either the manners or the figure of the paltry gallants, boldly stand on their defence, and with clubs, or whatever other arms they can provide, instead of answering their caresses, oblige their ugly visitors to retreat; not, however, before they have damaged or plundered every thing eatable they can lay their hands on.

---

[1] Omnes femellæ hujusce et precedentium, ut et fere sequentium specierum, menstruali patiuntur fluxu sicut in feminis.

[2] Buffon, vol. xxxviii. p. 183.

[3] In the true baboons the facial angle of the adult varies from 30° to 35°, and the superciliary crests are for the most part considerably elevated, as is also the ridge on the back of the head formed by the attachment of the temporal muscles, which, as well as the canine teeth, are large and powerful. The cheeks are furnished with pouches capable of much distension; and the muzzle terminates in a flattened extremity like that of the dog, on which the openings of the nostrils are situated. The tail is generally as long as, and sometimes even longer, than the body; but in several of the species it is extremely short. The callosities are frequently of large size and disgustingly conspicuous. This genus is generally considered as the lowest in organization, in capacity and intelligence, of the tribe to which it belongs.

The colour of the common baboon is reddish brown; his face and hands are black, and his upper eye-lids white. The hair of his cheeks forms a considerable tuft on each side; and the under surface of his body is but sparingly covered. In bulk he is equal to a middle sized dog; his proportions are thickset and inelegant; he is by no means dull or inactive. When young he is gay, playful, and docile; but as he grows older he becomes untractable, malicious, and ferocious. He is sometimes even dangerous, his muscular strength and agility, together with the great power of his teeth and jaws, rendering him a formidable opponent. On this account it is absolutely necessary to keep him strictly confined. He is a native of Africa, and more especially of the tropical parts of its western coast. For representation of the black baboon, see Plate XI. fig. 35; of the rib-nose baboon, Plate XII. fig. 8.

At the Cape of Good Hope, they are less formidable, but to the best of their power, equally mischievous. They are there under a sort of natural discipline, and go about whatever they undertake with surprising skill and regularity. When they set about robbing an orchard or a vineyard, for they are extremely fond of grapes, apples, and ripe fruit, they do not go singly to work, but in large companies, and with preconcerted deliberation. On these occasions, a part of them enter the inclosure, while one is set to watch. The rest stand without the fence, and form a line reaching all the way from their fellows within, to their rendezvous without, which is generally in some craggy mountain. Every thing being thus disposed, the plunderers within the orchard throw the fruit to those that are without as fast as they can gather it; or if the wall or hedge be high, to those that sit on the top; and these hand the plunder to those next them on the other side. Thus the fruit is pitched from one to another all along the line, till it is safely deposited at their head-quarters. They catch it as readily as the most skilful tennis-player can a ball; and while the business is going forward, which they conduct with great expedition, a most profound silence is observed among them. Their sentinel during this whole time continues upon the watch, extremely anxious and attentive; but if he perceives any one coming, he instantly sets up a loud cry, and at this signal the whole company scamper off. Nor yet are they at any time willing to leave the place empty-handed; for if they be plundering a bed of melons, for instance, they go off with one in their mouths, one in their hands, and one under their arm. If the pursuit is hot, they drop first that from under their arm, then that from their hand; and, if it be continued, they at last let fall that which they had hitherto kept in their mouths.

The natives of the Cape often take the young of these animals, and, feeding them with sheep and goat's milk, accustom them to guard their houses; which duty they perform with great punctuality. Those, however, that have been brought into Europe, are headstrong, rude and untractable. Dogs and cats, when they have done any thing wrong, will run off; but these seem careless and insensible of the mischief they do; and I have seen one of them break a whole table of china, as it should seem by design, without appearing in the least conscious of having done amiss. It was not, however, in any respect so formidable as that described by Mr Buffon, of which he gives the following description:—"It was not," says he, "extremely ugly, and yet it excited horror. It continually appeared in a state of savage ferocity, gnashing its teeth, flying at the spectators, and furiously restless. It was obliged to be confined in an iron cage, the bars of which it so forcibly attempted to break, that the spectators were struck with apprehension. It was a sturdy bold animal, whose short limbs and powerful exertions showed vast strength and agility. The long hair with which it was covered seemed to add to its apparent abilities; which, however, were in reality so great, that it could easily overcome a single man, unless armed. As to the rest, it for ever appeared excited by that passion which renders the mildest animals at intervals furious. Its lasciviousness was constant, and its satisfactions particular. Some others also of the monkey kind showed the same degree of impudence, and particularly in the presence of women; but, as they were less in size, their petulance was less obvious, and their insolence more easily corrected."

But however violent the desires of these animals may be, they are not found to breed in our climate. The female brings forth usually but one at a time, which she carries in her arms, and in a peculiar manner clinging to her breast. As to the rest, these animals are not all carnivorous; they principally feed upon fruits, roots, and corn, and generally keep together in companies. The internal parts are more unlike those of man than of quadrupeds, particularly the liver, which is, like that of a dog, divided into six lobes. The lungs are more divided, the guts in general are shorter, and the kidneys rounder and flatter.

The largest of the baboon kind is the MANDRIL; an ugly disgusting animal, with a tail shorter than the former, though of a much larger stature, being from four to five feet high. The muzzle is still longer than that of the preceding, it is of a bluish colour, and strongly marked with wrinkles, which give it a frightful appearance. But what renders it truly lothesome is, that from the nose there is always seen issuing a snot, which the animal takes care at intervals to lick off with its tongue, and swallow. It is a native of the Gold Coast; it is said to walk more frequently erect than upon all-fours; and when displeased, to weep like a child. There was one of them shown in England some years ago. It seemed tame, but stupid, and had a method of opening its mouth and blowing at such as came too near.

The WANDEROW is a baboon rather less than the former, with the body less compact and muscular, and the hinder parts seemingly more feeble. The tail is from seven to eight inches long; the muzzle is prominent, as in the rest of this kind; but what particularly distinguishes it, is a large long white head of hair, together with a monstrous white beard, coarse, rough, and descending; the colour of the rest of the body being brown or black. As to the rest, in its savage state, it is equally fierce with the others; but, with a proper education, it seems more tractable than most of its kind, and is chiefly seen in the woods of Ceylon and Malabar.[1]

The MAIMON of Buffon which Edwards calls the PIGTAIL, is the last of the baboons, and in size rather approaches the monkey, being no larger than a cat. Its chief distinction, besides its prominent muzzle, like a baboon, is in the tail, which is about five or six inches long, and curled up like that of a hog; from which circumstance, peculiar to this animal, our English naturalists gave it the name. It is a native of Sumatra, and does not well endure the rigours of our climate. Edwards, however, kept one of them a year in London; and another of them happening at the same time to be exposed in a show of beasts, he brought the two exiles together, to see if they would claim or acknowledge their kindred. The moment they came into each other's presence, they testified their mutual satisfaction, and seemed quite transported at the interview.[2]

THE MONKEY.

The varieties in the larger tribes of the monkey kind are but few; in the ape we have seen but four, and in the baboon about as many. But when we come to the smaller class, the differences among them seem too tedious for enumeration. These, as was observed in the beginning, are all small in stature, and with long tails, by which they are distinguished from the preceding, that entirely want the tail, or are large, and have but a short one. The varieties in the form and colour of dogs, or squirrels, is nothing to what are found among monkeys of the smaller kind. Bosman mentions above fifty sorts on the Gold Coast alone, and Smith confirms the account. Condamine asserts that it would take up a volume to describe the differences of these to be found along the river Amazons; and we are sure that every one of these is very different from those on the African coast. Naturalists, however, have undertaken to make a catalogue of their numbers; and they either transmit their descriptions from one to another, or only enumerate those few that have found their way to Europe, and have fallen within the narrow circle of their own observation. But though it may be proper enough to describe such as fall under notice, it is certainly wrong to offer a scanty catalogue as complete, and to induce the reader to suppose he sees a picture of the whole group of these animals, when he is only presented with a small part of the number. Such, therefore, as are fond of the reputation of adding new descriptions to the stock of natural history, have here a wide, though surely a barren, field to enlarge in; and they will find it no difficult matter, by observing the various animals of this kind that are from time to time brought from their native coasts to this country, to indulge in description, and to ring the changes upon all the technical terms with which this most pleasing science is obscured and rendered disgusting. For my own part, I will spare the reader and myself the trouble of entering into an elaborate description of each; content with observing once more, that their numbers are very great, and their differences very trifling. There is scarcely a country in the tropical climates that does not swarm with them, and scarcely a forest that is not inhabited by a race of monkeys distinct from all others. Every different wood along the coasts of Africa may be considered as a separate colony of monkeys, differing from those of the next district in colour, in size, and malicious mischief. It is indeed remarkable, that the monkeys of two cantons are never found to mix with each other, but rigorously to observe a separation: each forest produces only its own; and these guard their limits from the intrusion of all strangers of a different race from themselves. In this they somewhat resemble the human inhabitants of the savage nations among whom they are found, where the petty kingdoms are numerous, and their manners opposite. There, in the extent of a few miles, the traveller is presented with men speaking different languages, professing different religions, governed by different laws, and only resembling each other in their mutual animosity.

---

[1] The wanderoos belong to that group of the monkey tribes of the Old World which has received its name from the macaque, as being probably the most common of all the species that compose it. This group or genus is distinguished by a blunt and elongated muzzle, forming a facial angle of from 40° to 45°; by the prominence of the superciliary crests, which overhang the eyes and give a peculiar expression to the physiognomy; by the retrocession of the forehead above; and by the comparative shortness of the tail, which is rarely equal in length to the body, but is in some species nearly reduced to the dwarfishness of a pig-tail, and in one or two others is nothing more than a mere tubercle. In their manners there is considerable variety, dependent in a great degree upon their age, and the society to which they have been accustomed.

[2] *The Dog-Faced Baboon.*—They are betwixt four and five feet high; their head and face greatly resemble that of a dog; the hair is of a dusky colour, and peculiarly long and shaggy, as far as the waist, but short on the hinder parts. The face is naked, and the ears are pointed and concealed in the fur. The dog-faced baboons are natives of various parts of Africa and Asia. These animals usually associate in vast companies. When travellers pass near their haunts, they are impudent enough to run into the nearest trees, and shake the boughs with great vehemence, at the same time chattering very loudly. They are so powerful, as, without any difficulty, to overcome a man; and they frequently commit such depredations in cultivated grounds, that the proprietors are compelled to have armed men continually on the watch to prevent them from plundering.

Amongst the mountains in the neighbourhood of the Cape of Good Hope, there are immense troops of these baboons, or of a variety very nearly allied to them.* When any one approaches their haunts, they set up a universal and horrible cry for a minute or two, and then conceal themselves in their fortresses, and keep a profound silence. They seldom descend to the plains, except for the purpose of plundering the gardens that lie near the foot of the mountains.

* The Ursine Baboon.

In general, monkeys of all kinds, being less than the baboon, are endued with less powers of doing mischief. Indeed, the ferocity of their nature seems to diminish with their size; and when taken wild in the woods, they are sooner tamed, and more easily taught to imitate man, than the former. More gentle than the baboon, and less grave and sullen than the ape, they soon begin to exert all their sportive mimicries, and are easily restrained by correction. But it must be confessed that they will do nothing they are desired without beating; for if their fears be entirely removed, they are the most insolent and headstrong animals in nature.

In their native woods they are not less the pests of man than of other animals. The monkeys, says a traveller,[1] are in possession of every forest where they reside, and may be considered as the masters of the place. Neither the tiger, nor the lion itself, will venture to dispute the dominion, since these, from the tops of trees, continually carry on offensive war, and by their agility escape all possibility of pursuit. Nor have the birds less to fear from their continual depredations; for, as these harmless inhabitants of the wood usually build upon trees, the monkeys are for ever on the watch to find out and rob their nests; and such is their petulant delight in mischief, that they will fling their eggs against the ground, when they want appetite or inclination to devour them.

There is but one animal in all the forest that ventures to oppose the monkey, and that is the serpent. The larger snakes are often seen winding up the trees where the monkeys reside; and, when they happen to surprise them sleeping, swallow them whole, before the little animals have time to make a defence. In this manner, the two most mischievous kinds in all nature keep the whole forest between them; both equally formidable to each other, and for ever employed in mutual hostilities. The monkeys, in general, inhabit the tops of trees, and the serpents cling to the branches nearer the bottom, and in this manner they are for ever seen near each other, like enemies in the same field of battle. Some travellers, indeed, have supposed that their vicinity rather argued their mutual friendship, and that they united in this manner to form an offensive league against all the rest of animated nature.[2] "I have seen these monkeys," says Labat, "playing their gambols upon those very branches on which the snakes were reposing, and jumping over them without receiving any injury, although the serpents of that country were naturally vindictive, and always ready to bite whatever disturbed them." These gambols, however, were probably nothing more than the insults of an enemy that was conscious of its own safety; and the monkeys might have provoked the snake in the same manner as we often see sparrows twitter at a cat. However this be, the forest is generally divided between them; and these woods, which nature seems to have embellished with her richest magnificence, rather inspire terror than delight, and chiefly serve as retreats for mischief and malignity.

The enmity of these animals to mankind is partly ridiculous, and partly formidable. They seem, says Le Compte and others, to have a peculiar instinct in discovering their foes, and are perfectly skilled when attacked, in mutually defending and assisting each other. When a traveller enters among these woods, they consider him as an invader upon their dominions, and all join to repel the intrusion. At first they survey him with a kind of insolent curiosity. They jump from branch to branch, pursue him as he goes along, and make a loud clattering, to call the rest of their companions together. They begin their hostilities by grinning, threatening, and flinging down the withered branches at him, which they break from the trees; they even take their excrements in their hands, and throw them at his head. Thus they attend him wherever he goes; jumping from tree to tree with such amazing swiftness, that the eye can scarcely attend their motions. Although they take the most desperate leaps, yet they are seldom seen to come to the ground, for they easily fasten upon the branches that break their fall, and stick, either by their hands, feet, or tail, wherever they touch. If one of them happens to be wounded, the rest assemble round, and clap their fingers into the wound, as if they were desirous of sounding its depth. If the blood flows in any quantity, some of them keep it shut up, while others get leaves, which they chew and thrust into the opening: however extraordinary this may appear, it is asserted to be often seen, and to be strictly true. In this manner, they wage a petulant, unequal war; and are often killed in numbers before they think proper to make a retreat. This they effect with the same precipitation with which they at first came together. In this retreat the young are seen clinging to the back of the female, with which she jumps away, seemingly unembarrassed by the burden.

---

[1] Description Historique de Macacar, p. 51.

[2] Labat. Relat. de l'Afric. Occident. p. 318.

The curiosity of the Europeans has, in some measure, induced the natives of the places where these animals reside to catch or take them alive by every art they are able. The usual way in such case is to shoot the female as she carries her young, and then both, of course, tumble to the ground. But even this is not easily performed; for if the animal be not killed outright it will not fall; but clinging to some branch, continues, even when dead, its former grasp, and remains on the tree where it was shot until it drops off by putrefaction: in this manner it is totally lost to the pursuer; for to attempt climbing the tree, to bring either it or the young one down, would probably be fatal from the number of serpents that are hid among the branches. For this reason the sportsman always takes care to aim at the head; which if he hits, the monkey falls directly to the ground and the young one comes down at the same time, clinging to its dead parent.

The Europeans along the coasts of Guinea often go into the woods to shoot monkeys; and nothing pleases the negroes more than to see those animals drop, against which they have the greatest animosity. They consider them, and not without reason, as the most mischievous and tormenting creatures in the world; and are happy to see their numbers destroyed, upon a double account; as well because they dread their devastations, as because they love their flesh. The monkey, which is always skinned before it is eaten, when served up at a negro feast, looks so like a child, that an European is shocked at the very sight. The natives, however, who are not so nice, devour it as one of the highest delicacies; and assiduously attend our sportsmen to profit by the spoil. But what they are chiefly astonished at, is to see our travellers carefully taking the young ones alive, while they leave them the old ones, that are certainly the most fit to be eaten. They cannot comprehend what advantage can arise to us from educating or keeping a little animal that, by experience, they know to be equally fraught with tricks and mischief: some of them have been even led to suppose, that with a kind of perverse affection, we love only creatures of the most mischievous kinds: and having seen us often buy young and tame monkeys, they have taken equal care to bring rats to our factors, offering them for sale, and greatly disappointed at finding no purchaser for so hopeful a commodity.[1]

The negroes consider these animals as their greatest plague; and, indeed they do incredible damage when they come in companies to lay waste a field of Indian corn, or rice, or a plantation of sugar-canes. They carry off as much as they are able; and they destroy ten times more than they bear away. Their manner of plundering is pretty much like that of the baboons, already mentioned, in a garden. One of them stands sentinel upon a tree, while the rest are plundering, carefully and cautiously turning on every side, but particularly to that on which there is the greatest danger; in the meantime, the rest of the spoilers pursue their work with great silence and assiduity; they are not contented with the first blade of corn, or the first cane that they happen to lay their hands on; they first pull up such as appear most alluring to the eye; they turn it round, examine, compare it with others, and if they find it to their mind, stick it under one of their shoulders. When in this manner they have got their load, they begin to think of retreating; but if it should happen that the owners of the field appear to interrupt their depredations, their faithful sentinel instantly gives notice, by crying out *Houp, houp, houp!* which the rest perfectly understand, and all at once throwing down the corn they hold in their left hands, scamper off upon three legs, carrying the remainder in the right. If they are still hotly pursued, they then are content to throw down their whole burden, and to take refuge among their woods, on the tops of which they remain in perfect security.

Were we to give faith to what some travellers assure us, of the government, policies, and subordination of these animals, we might perhaps be taxed with credulity; but we have no reason to doubt that they are under a kind of discipline, which they exercise among each other. They are generally seen to keep together in companies, to march in exact order, and to obey the voice of some particular chief-tain remarkable for his size and gravity. One species of these which Mr Buffon calls the OUARINE, and which are remarkable for the loudness and distinctness of their voice, are still more so for the use to which they convert it. "I have frequently been a witness," says Margrave, "of their assemblies and deliberations. Every day, both morning and evening, the ouarines assemble in the woods to receive instructions. When all come together, one among the number takes the highest place on a tree, and makes a signal with his hand to the rest to sit round, in order to hearken. As soon as he sees them placed, he begins his discourse with so loud a voice, and yet in a manner so precipitate, that, to hear him at a distance, one would think the whole company were crying out at the same time; however, during that time, one only is speaking; and all the rest observe the most profound silence. When this has done, he makes a sign with the hand for the rest to reply; and at that instant they raise their voices together, until by another signal of the hand they are enjoined silence. This they as readily obey; till at last, the whole assembly breaks up, after hearing a repetition of the same preachment."

---

[1] Lebat, Relat. de l'Afric. Occident. p. 317.

The chief food of the monkey tribe is fruits, the buds of trees, or succulent roots and plants. They all, like man, seem fond of sweets; and particularly the pleasant juice of the palm-tree and the sugar-cane. With these the fertile regions in which they are bred seldom fail to supply them; but when it happens that these fail, or that more nourishing food becomes more agreeable, they eat insects and worms; and sometimes, if near the coasts, descend to the sea-shore, where they eat oysters, crabs, and shell-fish. Their manner of managing an oyster is extraordinary enough: but it is too well attested to fail of our assent. As the oysters in the tropical climates are generally larger than with us, the monkeys, when they go to the sea-side, pick up a stone, and clap it between the opening shells; this prevents them from closing; and the monkey then eats the fish at his ease. They often also draw crabs from the water, by putting their tail to the hole where that animal takes refuge, and, the crab fastening upon it, they withdraw it with a jerk, and thus pull their prey upon shore. This habit of laying traps for other animals makes them very cautious of being entrapped themselves; and I am assured, by many persons of credit, that no snare, how nicely baited soever, will take the monkey of the West India islands; for having been accustomed to the cunning of man, it opposes its natural distrust to human artifice.

The monkey generally brings forth one at a time, and sometimes two. They are rarely found to breed when brought over into Europe; but of those that do, they exhibit a very striking picture of parental affection. The male and female are never tired of fondling their young one. They instruct it with no little assiduity; and often severely correct it, if stubborn, or disinclined to profit by their example; they hand it from one to the other; and when the male has done showing his regard, the female takes her turn. When wild in the woods, the female, if she happens to have two, carries one on her back, and the other in her arms: that on her back clings very closely, clasping its hands round her neck, and its feet about her middle: when she wants to suckle it, she then alters their position; and that which has been fed gives place to the other, which she takes in her arms. It often happens that she is unable to leap from one tree to another, when thus loaden; and upon such occasions their dexterity is very surprising. The whole family form a kind of chain, locking tail in tail, or hand in hand, and one of them holding the branch above, the rest swing down, balancing to and fro, like a pendulum, until the undermost is enabled to catch hold of the lower branches of some neighbouring tree. When the hold is fixed below, the monkey lets go that which was above, and thus comes undermost in turn; but, creeping up along the chain, attains the next branches, like the rest; and thus they all take possession of the tree, without ever coming to the ground.

When in a state of domestic tameness, those animals are very amusing, and often fill up a vacant hour, when other entertainment is wanting. There are few that are not acquainted with their various mimicries, and their capricious feats of activity. But it is generally in company with other animals of a more simple disposition, that their tricks and superior instincts are shown; they seem to take a delight in tormenting them; and I have seen one of them amusing itself for hours together, in imposing upon the gravity of a cat. Erasmus tells us of a large monkey, kept by Sir Thomas More, that, one day diverting itself in his garden, where some tame rabbits were kept, played several of its usual pranks among them, while the rabbits scarcely well knew what to make of their new acquaintance: in the mean time, a weasel, that came for very different purposes than those of entertainment, was seen peering about the place in which the rabbits were fed, and endeavouring to make its way, by removing a board that closed their hutch. While the monkey saw no danger, it continued a calm spectator of the enemy's effort; but just when, by long labour, the weasel had effected its purpose, and had removed the board, the monkey stept in, and, with the utmost dexterity, fastened it again in its place; and the disappointed weasel was too much fatigued to renew its operations. To this I will only add what Father Carli, in his history of Angola, assures us to be true. In that horrid country, where he went to convert the savage natives to Christianity, and met with nothing but distress and disappointment; while his health was totally impaired by the raging heats of the climate, his patience exhausted by the obstinacy of the stupid natives, and his little provisions daily plundered without redress, in such an exigency he found more faithful services from the monkeys than the men; these he had taught to attend him, to guard him whilst sleeping, against thieves and rats, to comb his head, to fetch his water; and he asserts, that they were even more tractable than the human inhabitants of the place. It is indeed remarkable, that in those countries where the men are most barbarous and stupid, the brutes are most active and sagacious. It is in the torrid tracts, inhabited by barbarians, that such various animals are found with instinct so nearly approaching reason. The savages, both of Africa and America, accordingly suppose monkeys to be men; idle, slothful, rational beings; capable of speech and conversation; but obstinately dumb, for fear of being compelled to labour.

As of all savages, those of Africa are the most brutal, so, of all countries, the monkeys of Africa are the most expert and entertaining. The monkeys of America are, in general, neither so sagacious nor so tractable, nor is their form so nearly approaching that of man. The monkeys of the new continent may be very easily distinguished from those of the old, by three marks. Those of the ancient continent are universally found to have a naked callous substance behind, upon which they sit; which those of America are entirely without: those also of the ancient continent have the nostrils differently formed, more resembling those of men, the holes opening downward: whereas the American monkeys have them opening on each side; those of the ancient world have pouches on each side the jaw, into which they put their provisions; which those of America are without: lastly, none of the monkeys of the ancient continent hang by the tail, which many of the American sorts are known to do. By these marks the monkeys of either continent may be readily distinguished from each other, and prized accordingly. The African monkey, as I am assured, requires a longer education, and more correction, than that of America; but it is at last found capable of more various powers of imitation, and shows a greater degree of cunning and activity.

Mr Buffon, who has examined this race of imitative beings with greater accuracy than any other naturalist before him, makes but nine species of monkeys belonging to the ancient continent; and eleven belonging to the new. To all these he gives the names which they go by in their respective countries; which, undoubtedly, is the method least liable to error, and the most proper for imitation.

Of the monkeys of the ancient continent, the first he describes is the MACAGUO; somewhat resembling a baboon in size, strength of body, and a hideous wrinkled visage: it differs, however, in having a very long tail, which is covered with tufted hair. It is a native of Congo.

The second is the PATAS, which is about the same size with the former; but differs in having a longer body, and a face less hideous: it is particularly remarkable for the colour of his hair, which is of a red, so brilliant, that the animal looks as if it were actually painted. It is usually brought from Senegal; and by some called the *red African monkey*.[1]

The third of the ancient continent is the MALBROUK;[2] of which he supposes the monkey which he calls the BONNET CHINOIS to be a variety. The one is remarkable for a long tail, and long beard; the other for a cap of hair that covers the crown of the head, from whence it takes the name. Both are natives of the East Indies; and the Bramins, who extend their charity to all the brute creation, have hospitals for such of them as happen to be sick, or otherwise disabled.

---

[1] The Red Monkey of Pennant, the Patas of Buffon and the French writers, is well distinguished from all the other species by its peculiar colour and the singularity of its markings. The whole of the upper surface of its head, which is broad and flat, is of a deep rufous brown, which becomes lighter and assumes a rustier tinge on the back and on the outer sides of the limbs, and is continued along the tail until it is lost in the yellowish gray which terminates that organ. A patch of short dusky black hairs occupies the extremity of the nose, and extends upwards in a narrow line to the middle of the forehead, where it joins a series of long stiff coal-black hairs, forming an arch over each of the eyes, and separating the livid flesh-colour of the orbits and anterior part of the face from the red hairs which clothe the scalp. This double arch terminates in a somewhat expanded patch above the outer angles of the eyes. The sides of the upper lip are edged with a narrow line of the same short dusky hairs which cover the nose. Beneath the ears, which are blackish and moderately large, the hair forms broad thick bushy tufts of a light gray, which advance forwards upon the sides of the cheeks and lower jaw, so as to limit the naked part of the face to a narrow space between the eyes and the upper lip. From these tufts the hair is continued of the same colour on the whole of the under surface of the body, and on the inner sides of the limbs. The hands are dusky brown, with very short fingers, the thumb of the forehand especially being reduced almost to a mere tubercle. The facial angle is moderately elongated, and the nose flattened. The body measures about sixteen inches in length, and the tail is nearly equal.

[2] This animal forms the largest of the guenon tribe. From muzzle to tail it is about a foot and a half in length. In walking on the earth he always supports himself on his four hands—but as he is essentially organized for the purposes of climbing and living in trees, his movements on the ground possess neither firmness nor facility. His hinder limbs being longer than the fore, the motion of the anterior part of his body cannot correspond to that of the posterior, the latter proceeding with the greater rapidity. This obliges him to carry the hinder parts sometimes to the right, and sometimes to the left, when he intends a slow motion, and to shoot

The fourth of this kind is the MANGABEY; it may be distinguished from all others by its eye-lids, which are naked, and of a striking whiteness. It is a native of Madagascar.[1]

The fifth is the MONA, or the CEPHUS of the ancients: it is distinguished by its colour, which is variegated with black and red, and its tail is of an ash colour, with two white spots on each side at its insertion. It is a native of the northern parts of Africa.[2]

---

forward by jumps when he is desirous to run. This conformation, so unfavourable for animals designed to live on the earth, is peculiarly advantageous for such as are sustained on fruits. The disproportioned length of the hinder limbs in comparison of the fore, is no impediment to climbing, but imparts, on the contrary, a wonderful degree of agility in shooting from branch to branch, and even from tree to tree. Accordingly, we find that these monkeys rarely descend to the earth. Assembled in troops, they dwell for the most part in those capacious canopies of verdant foliage which cover the rich forests of Southern Asia, fellow-citizens with the birds, exposed to no danger but from the larger of the serpent tribe, or the more insatiable rapacity of man. In these lofty retreats they are found in such numbers, as to annoy the traveller, as well by the petulance of their motions as by the incessant iteration of their cries. Several specimens have been seen in Europe, of both sexes and of every age. There are no animals who can surpass them in agility. In confinement they are accustomed to shoot forward with such sustained vigour as to make several turnings in their course, as if flying, sustained in the air only by the impulse which they may receive from striking the walls of the cage. The malbrouks seldom suffer their voices to be heard, and never but in a shrill and feeble cry, or rather in a dull sort of grunting noise. The males, in their youth, are sufficiently docile, but as soon as they arrive at adult age they become excessively malicious, even towards the persons intrusted with their care. The females remain more gentle, and alone appear susceptible of attachment. Circumspection forms a very peculiar trait in the character of the malbrouk. He is nevertheless exceedingly irritable, but still, though subject to the most violent excitements from his ruling passions, he calculates all his movements with peculiar care, and executes them with surpassing dexterity. When he attacks, it is always from behind, and when the object of his resentment is unaware of his intention. He then precipitates himself upon him, wounds him with his teeth or nails, shoots away rapidly from within his reach, without however losing sight of him, and that as well for the purpose of seizing a favourable opportunity of renewing the attack, as to shelter himself from the vengeance of the adversary. This extreme irritability prevents the malbrouk from ever being completely tamed, or brought to submit with patience to restraint. He is susceptible of no other education than that of nature. The moment he is treated with violence, the moment it is endeavoured to compel him to obedience, his petulance is at an end; he becomes melancholy and silent, and speedily expires.

[1] This monkey (see Plate XII. fig. 6.) was called by Buffon the mangabey from an idea that it belonged to the territory of that name in the island of Madagascar: it appears, however, more probable that it is a native of the western coast of Africa. Its common English designation of the White Eyelid is certainly both expressive and appropriate; for although many others of the tribe, more especially among the baboons, have the same remarkable absence of colouring matter in the skin of their upper eyelids, yet in none (excepting only in the following species) has it a hue so perfectly dead-white or so strongly contrasted with the colour of the face. The latter was formerly regarded as a mere variety of the present; but the distinctions between them appear to be permanent, and are quite sufficient to justify their separation.

In the animal now under consideration, the head, the whole of the upper surface and sides of the body, the tail, and the outsides of the limbs, are of one uniform deep grayish black, or more properly soot-colour, becoming deep black on the lower part of the legs and on the hands. On the under part of the moustaches, which are bushy, spreading and directed backwards, the fore part of the chest, the under surface of the body, and the inside of the limbs, the general colour is of a light gray with only a slight mixture of a dusky hue. The fingers are long and slender; the ears rather small and blackish; and the whole face livid, with a blacker tinge round the eyes, and on the nose, lips, and chin. The tail is thick and cylindrical, scarcely tapering towards the point, and generally turned backwards over the body, which it exceeds in length.

This species is not destitute of intelligence, and is easily taught to perform a variety of antic tricks, to the effect of which the peculiar expression of its physiognomy greatly contributes. It is generally good tempered, and tolerably well-behaved, although not without its fair share of petulance and caprice.

The Collared White Eyelid Monkey.—The collared differs from the common white eyelid monkey principally in the deep chestnut brown of the upper surface of its head, and in the collar of pure white crossing the fore part of its neck and including the large bushy moustaches which extend forwards upon the cheeks and pass backwards beneath and behind the ears. The rest of the upper surface of the body is of the same slaty or soot-coloured hue as that of the former; the hands, face, and ears have nearly the same tinge; and the under surface is equally of a light ashy gray. Its form and proportions are similar, except that it is somewhat smaller. The legs are equally slender, and the tail equally long and thick. The hair which covers the body is also, as in the preceding species, long and soft to the touch. A remarkable character in the dentition of both, rendered particularly obvious by the taste for grinning in which these animals are so prone to indulge, consists in the great breadth of the two middle incisors of the upper jaw. It is this character, which, together with the prominence of their canine teeth, produces that greater extension of muzzle on which their generic distinction has been chiefly founded.

[2] If elegance of form, grace of motion, gentleness of disposition, superior sagacity, and penetration of physiognomy, presented characters to the naturalist proper for the purposes of classification, the mona, or varied monkey, would, incontestably, serve as a type for peculiar division. It is strikingly distinguished from the other guenons in general, by these qualities, and more especially from the malbrouk, the callitrix, and the grivet. Even the mangabey, though gentler than the others, is less so than the varied monkey. But this animal has no physical character, to confirm and establish the peculiar distinction to which its moral qualities would seem

The sixth is the CALLITRIX, or GREEN MONKEY of St Iago, distinguished by its beautiful green colour on the back, its white breast and belly, and its black face.[1]

The seventh is the MOUSTOC, or WHITE NOSE; distinguished by the whiteness of its lips, from whence it has received its name, the rest of the face being of a deep blue. It is a native of the Gold Coast, and a very beautiful little animal.

The eight is the TALAPOIN; and may be distinguished as well by its beautiful variety of green, white and yellow hair, as by that under the eyes being of a greater length than the rest. It is supposed to be a native of Africa and the East.[2]

The ninth and last of the monkeys of the ancient continent, is the DOUC, so called in Cochin-China, of which country it is a native. The douc seems to unite the characters of all the former together: with a long tail, like the monkey; of a size as large as the baboon; and with a flat face like the ape: it even resembles the American monkeys, in having no callosity on its posteriors. Thus it seems to form the shade by which the monkeys of one continent are linked with those of the other.

Next come the monkeys of the new continent; which, as has been said, differ from those of the old, in the make of their nostrils, in their having no callosity on their posteriors, and in their having no pouches on each side of the jaw. They differ also from each other, a part of them making no use of their tails to hang by; while others of them have the tail very strong and muscular, and serving by

---

to entitle it. In truth, this species of the varied monkey does not differ essentially from the other guenons but by its colours, and in these we discover a variety, which we do not recognise in the other species. Its head is of a brilliant golden green, its back and sides are of a beautiful marron, variegated with black. The exterior portion of the limbs, and of the tail, a pure slate-coloured gray, and its neck, chest, belly, and the internal facing of the limbs, a shining white. On each side of its cheeks are thick whiskers of a straw-coloured yellow mixed with black points, there are also other variations of colour, which we forbear to insist on, under the fear of becoming tedious. This variety of colour made Buffon imagine that the mona was the kebos of the Greeks. But this is mere conjecture. The ancients have rarely described monkeys so as to enable us to recognise the species of which they spoke. They confine themselves to naming the animals, as if they were ignorant that languages partook of the destinies of nations, or as if they had written only for the advantage of their contemporaries. The appellation of mona, a generic name in the East for all monkeys with long tails, has been bestowed by Buffon on this species in a manner no less arbitrary. However, as among us this name has no signification, it may assume without inconvenience this specific acceptation.—*Griffith.*

[1] As this monkey is found in Cape de Verd islands and the neighbouring parts of Africa, it is one of a species most frequently imported into Europe.

[2] In the jungles about the neighbourhood of Tillicherry, in India, there is a large species of monkey, frequently tamed by the natives; and at a village a short distance from this celebrated seaport, we had an evidence of the remarkable sagacity of this animal. A few yards from the house of the person to whom it belonged, a thick pole, at least thirty feet high, had been fixed into the earth, round which was an iron ring, and to this was attached a strong chain of considerable length, fastened to a collar round the monkey's neck. The ring being loose, it easily slid up the pole, when he ascended or descended. He was in the habit of taking his station upon the top of the bamboo, where he seemed perched as if to enjoy the beauties of the prospect around him; his was really striking. The crows, which in India are very abundant and singularly audacious, taking advantage of his elevated position, had been in the daily habit of robbing him of his food, which was placed every morning and evening at the foot of the pole. To this he had vainly expressed his dislike, by chattering, and other indications of his displeasure equally ineffectual; nothing that he could do was of any avail to scare away these unwelcome intruders upon his repasts. He tried various modes to banish them, but they continued their periodical depredations. Finding that he was perfectly unheeded, he adopted a plan of retribution as effectual as it was ingenious.

One morning, when his tormentors had been particularly troublesome, he appeared as if seriously indisposed: he closed his eyes, drooped his head, and exhibited various other symptoms of severe suffering. No sooner were his ordinary rations placed at the foot of the bamboo, than the crows, watching their opportunity, descended in great numbers, and, according to their usual practice, began to demolish his provisions. The monkey now began to slide down the pole by slow degrees, as if the effort were painful to him, and as if so overcome by indisposition that his remaining strength was scarcely equal to such exertion. When he reached the ground, he rolled about for some time, seeming in great agony, until he found himself close by the vessel employed to contain his food, which the crows had by this time well nigh devoured. There was still, however, some remaining, which a solitary bird, emboldened by the apparent indisposition of the monkey, advanced to seize. The wily creature was at this time lying in a state of apparent insensibility at the foot of the pole, and close by the pan. The moment the crow stretched out its head, and ere it could secure a mouthful of the interdicted food, the watchful avenger seized the depredator by the neck with the rapidity of thought, and secured it from doing further mischief. He now began to chatter and grin with every expression of gratified triumph, while the crows flew around, cawing in boisterous chime, as if deprecating the chastisement about to be inflicted upon their captive companion. The monkey continued for a while to chatter, and grin in triumphant mockery of their distress; he then deliberately placed the captive crow between his knees, and began to pluck it with the most humorous gravity. When he had completely stripped it, except the large feathers in the pinions and tail, he flung it into the air as high as his strength would permit, and, after flapping its wings for a few seconds, it fell on the ground with a stunning shock. The other crows, which had been fortunate enough to escape a similar castigation, now surrounded it, and immediately pecked it to death. The expression of joy on the animal's countenance was altogether indescribable; and he had no sooner seen this ample retribution dealt to the purloiner of his repast, than he ascended the bamboo to enjoy a quiet repose. The next time his food was brought, not a single crow approached it; and I dare say that, thenceforward, he was never again molested by those voracious intruders. —*Oriental Annual*, 1836.

way of a fifth hand to hold by.[1] Those with muscular holding tails, are called SAPAJOUS; those with feeble useless tails, are called SAGOINS. Of the sapajous there are five sorts: of the sagoins there are six.

The first of the sapajous is the WARINE, or the BRAZILIAN GUARIBA. This monkey is as large as a fox, with long black hair, and remarkable for the loudness of its voice. It is the largest of the monkey kind to be found in America.

The second is the COATI; which may be distinguished from the rest by having no thumb, and consequently but four fingers on the two fore-paws. The tail, however, supplies the defects of the hand; and with this the animal slings itself from one tree to another, with surprising rapidity.

The third is the SAJOU; distinguished from the rest of the sapajous by its yellow flesh-coloured face.

The fourth is the SAI. It is somewhat larger than the sajou, and has a broader muzzle. It is called also the BEWAILER, from its peculiar manner of lamenting when either threatened or beaten.

The fifth and last of the sapajou kind, or monkeys that hold by the tail, is the SAMARI, or AURORA; which is the smallest and most beautiful of all. It is of a fine orange colour, with two circles of flesh round the eyes. It is a very tender, delicate animal, and held in high price.

Of the sagoins with feeble tails there are six kinds. The first and the largest is the SAKI, or CAGUI; so remarkable for the length of the hair on its tail, that it has been often termed the FOX TAILED MONKEY. It is of different sizes; some being twice as large as others.

The second of this kind is the TAMAIN; which is usually black, with the feet yellow. Some, however, are found all over brown, spotted with yellow.

The third is the WISTITI; remarkable for the large tufts of hair upon its face, and its annulated tail.[2]

The fourth is the MARIKINA; with a mane round the neck, and a bunch of hair at the end of the tail, like a lion.

The fifth is called the PINCH; with the face

---

[1] There are no apes or monkeys without a tail known in America, and but one species with a tail shorter than the body, which was lately discovered by the Baron Humboldt. Of American monkeys several figures are given in the plates. Plate XII. fig. 10. the horned sapajou; fig. 11. the douroncouli; fig. 12. the cacajao. Plate XIII. fig. 36. the coaita; fig. 37. the capparo; fig. 38. the araguato; fig. 39. the siamira.

[2] *The Striated Monkey.* (See Plate XIII. fig. 52.) This animal is, in size, no larger than a squirrel. The tail is long, and beautifully marked through its whole length, with alternate rings of black and white. The body is of a reddish ash-colour, slightly undulated with dusky shades. Striated monkeys live in society, on trees, the females carrying their young ones firmly clinging to their backs. They are found in the woods and forests of South America, where they are believed to subsist chiefly on fruits and vegetables: those, however, which have been kept in a state of captivity, have been known to feed on fish, insects, and worms. One that was brought to England in an East India ship, would eat nuts, but could not be prevailed with to touch ripe fruits. This creature was peculiarly fond of the smaller kinds of spiders and their eggs; but he uniformly refused the larger ones, as well as the large blue bottle-flies, though he frequently ate those of the common species.

The Entellus Monkey. (See Plate XII. fig. 4.) Although there is reason to believe that this is one of the most common monkeys both of Hindostan and the islands of the Indian archipelago, it has seldom been brought alive to this country. On the continent of Europe specimens appear to be almost equally rare. The species was first made known by M. Dufresne, in 1797, from a skin in his possession, which was shortly afterwards figured by Audebert in his large work on the Monkeys, whence it was adopted by later zoologists. After an interval of more than twenty years the arrival of a living individual of small size and immature age, at the Jardin du Roi, in Paris, enabled M. Frederic Cuvier to publish a second original figure, more valuable than the first, as having been taken from the life. The same naturalist has subsequently given a still more striking and characteristic likeness of the adult animal, taken from a drawing sent from India by M. Duvaucel. These figures and the observations which accompany them, constitute the sum of all that has hitherto been known to science respecting this very remarkable and interesting species.

The genus semnopithecus of M. F. Cuvier, of which the entellus offers a truly characteristic example, is distinguished from the other monkeys of the Old World by several remarkable characters, affecting not only its outward form but also some essential parts of its internal organization. In the degree of their intelligence, the form of their heads, and the general outline of their proportions, the species which compose it seem to occupy an intermediate station between two other purely Asiatic groups, the gibbons of Buffon, which are the hylobates of modern systematists, and the macaques, of which the wanderoo may be regarded as the type. Their bodies are slightly made; their limbs long and slender; their tails of great length, considerably exceeding that of the body; their callosities of small size; and their cheek-pouches, in those species which appear to possess them, so inconsiderable as scarcely to deserve the name. The character, however, which at once distinguishes them from the cercopitheci, is found in their dentition, and more particularly in the form of the crown of the last molar tooth of the lower jaw, which, instead of four tubercles, one at each angle of the tooth, as in the latter genus, offers five such projections on its surface, the additional one occupying the middle line of the tooth, and being placed posteriorly to the rest. The gibbons and the macaques are also furnished with this additional tubercle.

The entellus is too distinct a species to be confounded with any other. It is of a uniform ashy-gray on the upper parts, becoming darker on the tail, which is grayish brown, of equal thickness throughout, and terminated by a few long hairs running out into a kind of point, but not forming a tuft. The under surface of the body is of a dingy yellowish white; and the fore arms, hands, and feet are of a dusky black. The fingers of both extremities are very long, and the thumbs comparatively short. The face, which is black with somewhat of a violet tinge, is surmounted above the eyebrows by a line of a beautiful black, and white hair that descends on each side of the face like that of man.

The last, least, and most beautiful of all, is the MICO, an animal too curiously adorned not to demand a particular description; which is thus given of it by Mr Condamine:—"That," says he, "which the governor of Para made me a present of, was the only one of its kind that was seen in the country. The hair on its body was of a beautiful silver colour, brighter than that of the most venerable human hair; while the tail was of a deep brown, inclining to blackness. It had another singularity more remarkable than the former; its ears, its cheeks, and lips, were tinctured with so bright a vermilion, that one could scarcely be led to suppose that it was natural. I kept it a year; and it was still alive when I made this description of it, almost within sight of the coasts of France: all I could then do was to preserve it in spirits of wine, which might serve to keep it in such a state as to show that I did not in the least exaggerate in my description.

OF THE MAKI.

The last of the monkey kind are the makies; which have no other pretensions to be placed in this class, except that of having hands like the former, and making use of them to climb

---

of long stiff black hairs, which project forwards and slightly upwards. On the sides of the cheeks and beneath the chin it is margined by a beard of grayish white passing along the line of the jaws and extending upwards in front of the ears, which are large and prominent, and of the same colour with the face. The hairs of the fore part of the head appear to diverge from a common centre.—*Griffith.*

DIANA, OR PALATINE MONKEY *(Cercopithecus Diana).* This animal takes its name from the white crescent-shaped band that adorns its brow. It is a native of the eastern coast of Africa, and is about eighteen inches in length, with a tail exceeding two feet. It is fond of all kinds of vegetables, and more particularly of fruits, raisins, nuts, and almonds; is easily irritated, and very sensitive to cold. (Pl. XLIII. fig. 2.)

THE VARIED MONKEY *(Cercopithecus mona.)* Is brought from Africa, and said to be a native of Barbary; it is possessed of much cunning and adroitness, and is fond of being caressed. It exhibits none of the disgusting manners so common to the monkey tribe. Of its habits in a wild state nothing is known. (Pl. XLIII. fig. 4.)

THE GUEREZA MONKEY *(Colobus Guereza).* This belongs to a genus of quadrumanous animals, of which there are several species. They are natives of Africa, and are distinguished by their long silky hair, which covers the head and upper part of the body. The *Colobus guereza* was discovered by Dr. Russell, in Abyssinia. It is black, and has long flowing white hair over the sides and back. (Pl. XLIII. fig. 3.)

D'Obsonville, a French traveller in India, thus speaks of the appearance and mode of dealing with the monkey tribes:—Every race of monkeys lives in society, and forms a kind of horde, consisting of from fifty to two hundred or three hundred individuals. Each has its chief, remarkable by his size and superior deportment; he is indebted for his rank to his strength and courage; and a habit of respect and fear seems to be preserved towards him, even in old age, though not perhaps in decrepitude. When I have been travelling, I have occasionally entered the antique temples to repose myself, when my Indian dress gave these animals little suspicion; for notwithstanding their apparent disregard, they are exceedingly observant. I have seen several of them at first considering me, and looking attentively at my food; their eyes and agitation painted their inquietude, their passion to gormandise, and the strong desire they had to appropriate at least a part of my repast to themselves.

As the sorts of rencounters were amusing to me, I always took care to provide myself with parched peas; at first I would scatter a few on that side where the chief was, and he would approach by degrees, and collect them with avidity. I have afterwards presented my hand full; and in the place most sanctified, where they are accustomed to see none but pacific men, who make a conscience of not disturbing them, the chief would venture to approach, though at first sidling, and fixing his eyes upon me, to divine if I had not some sinister purpose against him. Presently becoming bold, he would seize the thumb of my hand in which I held the peas, with one, and eat with his other hand, still keeping his eyes fixed on mine. If I laughed or stirred, he would break off his repast, and, working his lips, make a kind of muttering; the sense of which his long canine teeth, occasionally shown, plainly interpreted. When I threw a few at a distance, he seemed satisfied that others should gather them up; but he grumbled at and sometimes struck those that inconsiderately came too near me. His cries and solicitude, though in part the effect, perhaps, of greediness, apparently indicated his fear lest I should take advantage of their weakness to ensnare them; and I constantly observed, that those which were suffered to approach the nearest were the well-grown strong males; the young and the females were always obliged to keep at a considerable distance.

The care and tenderness of the mothers towards their offspring did not appear less conspicuous; they held them under a proper obedience and constraint. I have very often seen them suckle, caress, and cleanse them, and afterwards crouching on their hams, delight to see them play with each other. They would wrestle, throw, or chase one another; and if any of them were malicious in their antics, the dams would spring upon them, growling, and seizing them with one hand by the tail, correct them severely with the other. Some of them would immediately try to escape, but when they were out of danger, would approach in a wheedling and caressing manner, though ever liable to relapse into the same faults; in other cases, each would come at the first cry of their dam. If they removed to a little distance, the young would follow gently; but they mounted on her back, or rather hung by embracing her under the belly, if it was necessary to go swiftly. They are generally peaceable enough among each other; in extensive, solitary, and fertile places, herds of different species come, go, and sometimes jabber together, without disturbance or confusion of race. However, if adventurous stragglers seem desirous of seeking their fortunes on the trees, countries, or places which another herd has appropriated to itself, they immediately unite to sustain their rights of possession with vigour. I have had no opportunity of seeing any of their most serious encounters; but I will relate a little affair which I saw, and of which many others were witnesses.

Several herds of a species of monkeys, about three feet and a half high, were settled in the enclosures of the pagodas of Cheringam. One of the long-bearded monkeys had stolen in, and was soon discovered. At the first cry of alarm, many of the males united, and trees, or to pluck their food. Animals of the hare kind, indeed, are often seen to feed themselves with their fore-paws, but they can hold nothing in one of them singly, and are obliged to take up whatever they eat in both at once: but it is otherwise with the maki; as well as the monkey kinds, they seize their food with one hand, pretty much like a man, and grasp it with great ease and firmness. The maki, therefore, from this conformation in its hands both before and behind, approaches nearly to the monkey kind; but in other respects, such as the make of the snout, the form of the ears, and the parts that distinguish the sexes, it entirely differs from them. There are many different kinds of these animals; all varying from each other in colour or size, but agreeing in the human-like figure of their hands and feet, and in their long nose, which somewhat resembles that of a dog. As most of these are bred in the depths of the forest, we know little more concerning them than their figure. Their way of living, their power of pursuit and escape, can only be supposed, from the analogy of their conformation, somewhat to resemble those of the monkey.

The first of this kind is the MOCOCO; a beautiful animal, about the size of a common cat, but the body and limbs slenderer, and of a longer make. It has a very long tail, at least double the length of its body; it is covered with fur, and marked alternately with broad rings of black and white. But what it is chiefly remarkable for, besides the form of its hands and feet, is the largeness of its eyes, which are surrounded with a broad black space; and the length of the hinder legs, which by far exceed those before. When it sleeps, it brings its nose to its belly, and its tail over its head. When it plays, it uses a sort of galloping, with its tail raised over its back, which keeps continually in motion. The head is covered with dark ash-coloured hair; the back and sides with a red ash-colour and not so dark as on the head; and the whole glossy, soft, and delicate, smooth to the touch, and standing almost upright like the pile of velvet. It is a native of Madagascar; appears to be a harmless gentle animal; and though it resembles the monkey in many respects, yet it has neither its malice nor its mischief: nevertheless, like the monkey, it seems to be always in motion; and moves, like all four-handed animals, in an oblique direction.

A second of this kind, which is also a native of Madagascar, is the MONGOOS; which is less than the former; with a soft glossy robe. but a little curled. The nose also is thicker than that of the mococo; the eyes are black with orange-coloured circles round the *pupil;* and the tail is of one uniform colour. As to the rest, it is found of various colours; some being black, others brown; and its actions somewhat resemble those of a monkey.

The VARI is much larger than either *of the* former; its hair is much longer, and it has a kind of ruff round the neck, consisting of very long hair, by which it may be easily distinguished from the rest. It differs also in its disposition, which is fierce and savage; as also in the loudness of its voice, which somewhat resembles the roaring of the lion. This also is a native of Madagascar.

To this tribe we may refer a little four

---

ran to attack the stranger. He, though superior in size and strength, and one of the most vigorous among his own species, saw his danger, and flew to attain the top of a pyramid eleven stories high, whither he was instantly followed, and seemed ready to be assailed on all sides; but when arrived at the summit of the building, which terminated in a very small round dome, he placed himself firm, and, taking advantage of his situation, seized three or four of the most hardy, and precipitated them to the bottom. These proofs of his prowess intimidated the rest; and after much noise, they thought proper to retreat. The conqueror remained till evening, and then betook himself to a place of safety.

The mountains and woods, which abound in pulse and wild fruits, furnish plenty of subsistence to different species of monkeys; besides, that most of them might, in case of need, become carnivorous, since in a state of liberty they willingly, and by preference, eat eggs and insects. They do not want resources for life then; but had they twice as many, the stolen morsel with them is always the sweetest. Never satisfied with what nature affords, they seldom miss an occasion to steal whatever they can from houses, or at least to maraud in the gardens and cultivated lands. However, as this is attended with danger, some lurk in obscure places and watch, while others do the business; and the guard is sure to give a shrill cry, by way of alarm, when any precaution is necessary. Those who inhabit the tops of ancient temples, will descend among the inhabitants of the pacific tribes of Indians settled near them, and rob them whenever they can. These Indians are obliged to keep every thing under lock and key, or their houses are soon pillaged. If one of these animals perceive a child by itself with bread or fruit, he will often go and steal it: and if the child make any resistance, will shake him with an angry countenance, or perhaps give him a gentle bite. If a woman is drying grain in the sun, she is obliged to stand with a stick in her hand, not with an intention to hurt them, but because a parcel of these thieves are sometimes clinging to the tiles and walls, and others skipping round, all of which perfectly understand how to take advantage of the least inattention. Thus, while she threatens or chases such as seem the most enterprising, others behind her watch the proper moment, and seize it with all the address imaginable.

It is evident a little powder and shot would soon rid them of such troublesome visitors. This is often done by the Mahometans; but this expedient, especially in temples, would draw down a thousand curses on the traveller's head, and might be attended with dangerous consequences in those countries where the Hindoos are the masters, or have an ascendancy by their numbers. I saw a French soldier receive two strokes with a sabre, and was with difficulty rescued from the populace of Benglour, a town at that time belonging to Hyder Ali, and under the Mahometan administration, for killing a monkey that had eaten his food.

handed animal, of the island of Ceylon, which Mr Buffon calls the LORI; very remarkable for the singularity of its figure.[1] This is, of all other animals, the longest in proportion to its size; having nine vertebræ in the loins: whereas other quadrupeds have only seven. The body appears still the longer by having no tail. In other respects, it resembles those of the maki kind; as well in its hands and feet, as in its snout, and in the glossy qualities of its hair. It is about the size of a squirrel; and appears to be a tame, harmless little animal.

OF THE OPOSSUM, AND ITS KINDS.[2]

To these four-handed animals of the ancient continent, we may add the four-handed animals of the new, that use their hands like the former, as well as their tails, and that fill up the chasm between the monkey tribe and the lower orders of the forest. As the maki kind, in some measure, seem to unite the fox and the monkey in their figure and size, so these seem to unite the monkey and the rat. They are all less than the former; they have long tails, almost bare of hair; and their fur, as well as their shape, seems to place them near

---

[1] In the island of Madagascar, near as it is to the coast of Africa, which in almost every part offers "a wilderness of monkeys," none of those animals are to be found. This fact is the more remarkable when we consider the latitudinal range through which the multitudinous family of simiæ is distributed. If, however, this sultry island be untenanted by monkeys, it is supplied, as if to compensate for the deficiency, by a singular group of quadrumanous animals, which may be said to take their place, a group peculiar to Madagascar and two or three small contiguous islands: these are known under the various names of macaucos, mongoos, makis, and Madagascar cats. They constitute the genus *Lemur*. The true lemurs constitute a tolerably numerous genus, thirteen distinct species being now acknowledged, of which one, the *Lemur rufifrons*, has been lately made known to science. (See Proceedings of Zool. Soc. for 1833, p. 106.)

There is something in the appearance, habits, and manners of the lemurs very peculiar. Though quadrumanous, like the monkey, the limbs have a contour very dissimilar to what we see in those animals, and indeed neither the fore nor hind-paws are those of a monkey, for the thumb of the fore-paws is short and feeble, while on the hind-paws it is long, and gradually dilates into an expanded flattened tip. The anterior limbs are short and muscular, but the posterior pair are elongated and slender; the body is slender, well turned, much resembling that of a cat: it terminates in a long, full-furred tail; the head is somewhat rounded on the top, but is reduced into a long pointed muzzle; the eyes are large, bright, and evidently adapted for nocturnal vision, the incisor teeth are four above and six below, the latter being long, compressed laterally, and projecting almost horizontally forwards; the canines are long, pointed, and sharp-edged, especially those of the upper jaw, which are indeed formidable weapons: the grinders have much of the insectivorous character about them, the tubercles along their outer edge being sharp and conical.

Wild and savage, they avoid the presence of man, but defend themselves with great obstinacy if attacked or in danger of being captured. When taken young, however, they become easily reconciled to captivity, and are usually gentle and familiar, fond of being noticed, and become attached to those who feed and attend to them; but we have known them in moments of anger bite those to whom they were most accustomed, and that with great severity.

The activity of the lemurs is very remarkable. They traverse the trees of the forest, taking long sweeping bounds from branch to branch with the utmost ease and grace; during the hours of twilight they are constantly in motion. They are in fact nocturnal or crepuscular animals, sleeping in their retreats or among the dense foliage during the day, and rousing up as evening steals on to commence their search for food, or to gambol with their fellows. Fruits, insects, reptiles, small birds, and eggs constitute their means of subsistence. Of the habits of these singular creatures in a state of nature much is yet unknown. In captivity they are interesting from the peculiarity of their appearance and manners; yet they are certainly far less intelligent than monkeys, and display but little inquisitiveness or playfulness. They are extremely sensible of cold, and always appear chilly. If allowed to approach a fire they will sit up, spread their hands, half close their eyes, and evince the most marked signs of the pleasure they derive from the increased temperature. At other times they endeavour to maintain a due degree of warmth by folding their long tails round the body, and where two are in the cage together it is very common to see them crouching close to each other, so as to resemble a ball of fur. In this manner they sit on their perch, presenting an odd appearance, for the head is snugly doubled between the arms upon the chest so as not to be visible. Chilly as they are, however, the lemurs, with due care, bear our atmosphere and changes much better than many animals belonging to far less sultry climates.

[2] Pouched animals were known at first only in America; all the species found on that continent agree so completely in general organization, as well as in this peculiar conformation of the genitals, that Linnæus found in them the elements of a single genus, which he called *Didelphis* or double-wombed. Afterwards from the East Indies, and still later from the regions of Australasia, animals arrived equally distinguished by the possession of the abdominal pouch; these were immediately set down as genuine *Didelphes*, and Gmelin has bestowed on them the titles of *Didelphis Orientalis*, *Didelphis Brunii*, &c.; and even the *Tarsier* of Daubenton he inscribed among them, under the name of *Didelphis Macrotarsus*. None, however, of these animals answered to the definition of Linne; all had less than six incisors above, and less than eight below, &c.: nevertheless, Pallas, Camper, and Zimmermann still preserved the appellation of Gmelin, and thus prolonged the abuse.

At first an opinion arose that the young of these animals were actually produced in the abdominal pouch beside the mammæ of the mother. It is nearly two centuries since Marcgrave has said, "The pouch is properly the matrix of the carigueya (*Didelphis Opossum*.) I have been unable to find any other; this is a point which I have ascertained by dissection. The semen is produced there, and the young are formed." Pison confirms the same facts, having, as he observes, dissected many of the carigueyas. Valentyn, makes the same assertion, in his account of the Molucca islands: "The pouch of the philanders is a matrix in which the young are conceived. This pouch is not what is usually supposed. The mammæ are, with regard to the young, what stalks are to their fruits." The young remain attached to the mammæ, until they have attained maturity, and then separate from them as the fruit drops from the stalk.

These notions are also common in Virginia, even among physicians. Beverly says, that the young opossum exists in the false belly, without ever entering the true, and are developed on the teats of the mother. The Marquess of Chastellux makes a similar remark. Hence Pennant says, "That suspended to the mammæ of the mother, they remain there at first without motion: this lasts until they have acquired some developement and strength; but then they undergo a second birth."

Two opossums, (*Didelphis Virginiana,*) male and female, were domesticated in the house of M. d'Aboville, in 1783; these animals copulated, and the effects were attentively observed by that gentleman: in about ten days the edge of the orifice of the pouch grew thicker, a phenomenon which afterwards grew more perceptible. As the pouch increased in size, the orifice widened. On the thirteenth day, the female did not quit her retreat except to eat, drink, and evacuate: on the fourteenth she did not stir from it. M. d'Aboville then determined to seize and examine her: the pouch, the aperture of which had widened before, was now nearly closed; a slimy secretion moistened the hairs on its circumference. On the fifteenth day, a finger was introduced into the pouch, and a round body about the size of a pea was plainly felt at the bottom. This examination was made with difficulty, on account of the impatience of the mother, who had before this been always very mild and tranquil. On the seventeenth, she permitted a further examination, and M. d'Aboville discovered two bodies about the size of a pea. There was, however, a great number of these young ones. On the twenty-fifth day, they moved very perceptibly, yielding to the touch:' on the fortieth, the pouch was sufficiently open for them to be plainly distinguished; and on the sixtieth, when the mother lay down, they were seen hanging to the teats, some outside the pouch, some inside. The nipple is about two-eighths of an inch in length; but it soon dries up, and at last drops off, after the manner of the umbilical cord.

M. Geoffroy, lamenting the vagueness and obscurity existing on the subject of pouched animals, wrote an article in 1819, with this query as title, "Are the pouched animals born attached to the teats of the mother?" His object was to call the attention of scientific men to the subject, and more especially of those who possess the means of investigation in those countries which form the habitat of the animals. His observations are highly interesting and important. On the pouch, he remarks that it is not, in the adult female, a cavity of equal capaciousness at all times. M. d'Aboville observed it to increase in magnitude under the influence of the phenomena of generation, and M. Geoffroy himself has observed its relative dimensions in females of the same species. It is small previous to sexual intercourse, large to excess when the young ones are about to drop from the mammæ, and of a moderate size in the period immediately following. Thus the pouch cannot be considered merely as a *second domicile*, without spring or activity; it is a true place of incubation, extending by degrees, acquiring more and more volume, as happens to every other *domicile* of the fœtus. Well, therefore, might it be called a second uterus, and the most important of the two.

As to the mode in which the young are placed in the external pouch, or rather attached to the nipple, nothing is accurately known. A communication between the external uterus and this pouch has been asserted to exist, but never demonstrated. Some have imagined that the mother placed the young there herself with her hands and feet; but this is not very likely. Another opinion was, that the pouch extended to the orifice of the vagina; but the muscles do not seem disposed for such an arrangement, and some species have no pouch.

Pouched animals derive their appellation of *Marsupiata* or, as some call them, *Marsupiales*, from the character of the pouch. It may, however, be well questioned, whether as a generic or classic term, it be unobjectionable. There are many species in which this character of the pouch does not exist, while, on the contrary, there are none without the double matrix, which would render the Linnæan appellation of didelphis more universally suitable to all the species. Be that as it may, the marsupiata are unquestionably the most singular of all known quadrupeds. With the exception of the peculiarities of their generation, there is scarcely any character in common among them. The organs of locomotion and digestion vary considerably, and that in a manner so nicely graduated, that all the shades between the carnassiers, properly so called, and the genuine rodentia, are discoverable among the animals in question by the character of the teeth. Their extremities are equally modified from those which are designed to dig the earth, to those adapted for climbing with the utmost facility the loftiest trees.

The physiognomy of these animals is in relation to their natural habits and mode of living. The *didelphes* and dasyuri have a conic head, elevated ears, mouth deeply cut, and the aspect of carnivora. The perameles rather resemble rats, the long-legged kanguroos, *hares*, and the phascolomys the marmot. Some, such as the didelphis and dasyuri, are carnassiers, living on eggs, small birds, and corrupted flesh, and sometimes crustacea and insects. Others, as the kanguroo and phascolomys, are sustained purely on vegetables. The phalangers are probably both frugivorous and insectivorous.

They are all remarkable for the imperfect developement in which the young are born. Even in the species without pouches, and with prehensile tails, the *young* hang under the belly of the mother for a certain time; then they mount on her back, and twist their tails round hers to fix themselves. The young of the koala, *which* has no tail, fixes itself on the parent's back, and fastens there with its hands. The number of the young is variable. In the didelphes, from ten to twelve, *and in* the kanguroo, usually but one.

The marsupiata are generally solitary. Some remain constantly on the trees, the didelphes, the phalangers, and koalas. Others ferret continually in the rocks on the seashore, as the dasyuri. Others remain constantly at the bottom of their burrows (the phascolomys). *The* kanguroos, feeble animals, and without means of defence, live in troops. They alone serve for the purposes of nourishment to man, whom they avoid only by *means* of that activity with which they execute such rapid and extended leaps. Their skins are the only clothing worn by the natives of those countries which they inhabit.

A very remarkable fact is, that the marsupiata have as yet, been observed only in South America, New Holland, and some islands of the Indian archipelago. The didelphes, properly so called, or the sarigues, and the chironectes, are proper to the first of these countries. All the others, except the phalangers, with naked and scaly tails, are peculiar to the second; and those last mentioned phalangers, and a species of the kanguroo, are alone to be met with in the Indian archipelago. *It* is remarkable that all the mammalia known in New Holland, to the present day, with the exception of the dog, and the hydromys with white belly and that with yellow, belong to the marsupiata. To this continent also belong the ornithorhynci and echidnæ, which have also the marsupial bones in both sexes, but whose organs of generation are peculiarly conformed, and in which no mammæ have yet been observed. These animals have the rat kind. Some have accordingly ranked them in that class; but their being four-handed is a sufficient reason for placing them in the rear of the monkeys.

The first, and the most remarkable of this tribe is the OPOSSUM, an animal found both in North and South America, of the size of a small cat. The head resembles that of a fox; it has fifty teeth in all, but two great ones in the midst like those of a rat. The eyes are little, round, clear, lively, and placed upright; the ears are long, broad, and transparent, like those of the rat kind; its tail also increases the similitude, being round, long, a little hairy in the beginning, but quite naked towards the end. The forelegs are short, being about three inches long; while those behind are about four. The feet are like hands, each having five toes or fingers with white crooked nails, and rather longer behind than before. But it is particular in this animal, that the thumb on the hinder legs wants a nail; whereas the fingers are furnished with clawed nails as usual.

But that which distinguishes this animal from all others, and what has excited the wonder of mankind for more than two centuries, is the extraordinary conformation of its belly, as it is found to have a false womb, into which the young, when brought forth in the usual manner, creep, and continue for some days longer, to lodge and suckle secure-

---

so great an analogy with the marsupiata, that M. de Blainville puts them in the same sub-class. But M. Geoffroy has separated them from the other mammalia, to form an order which he calls MONOTREMES.

The characteristics of the opossum may be thus represented. The toes are five to each foot, armed with very feeble claws, and the great toes of the hind feet are altogether without them, and are opposable to the other toes, the hind feet thus forming real hands, to which the name of *pedimanes* has been given. The opossums move their feet very singularly in walking, which is to them an operation of labour and difficulty. The tail is flexible, and very strong; and the animal is reported to suspend himself by it in order to watch for passing prey. It does not appear that the opossums have any other voice than a blowing like that of cats when menacing. The females have under the belly a pouch, in which it is believed that the young opossums, born prematurely, complete their developement. This particular organ, which has the power of opening and closing, contains the teats, which seem to vary in number, twelve having been found in one female, while another only had ten. The opening is a longitudinal cleft, which conducts backward to a bag of very small dimensions, the abode of the young ones, and which extends with age and the number of young it is required to accommodate. The period of gestation is about twenty-six days, and the young sojourn about fifty in the pouch. Azara has seen the young about five inches long, with their eyes closed, and the hair just beginning to appear, adhering to the teat, their hold on which they retain with remarkable tenacity. The animal is eleven inches in length, from the occiput to the root of the tail; the tail is about the same extent; the head is six inches; and the height, at the fore part of the back, is from seven to eight inches. The body is of a greyish-yellow colour, resulting from the hairs being dirty-white in most of their length, and black or brown at the extremities; but some entirely black hairs are here and there interspersed with the white. The feet, the ears, and the extremity of the snout, are naked.

The organs of sense and motion in the opossum do not offer many indications of activity and strength. His little eyes are nearly without eyelids, though the nictitating membrane is well developed, and completely covers the eye, which is rather prominent, resembling the segment of an ellipsis, with a pupil of vertical length, like that of a cat. His nostrils, at the extremity of a long snout which overhangs the jaw, open upon the sides of a naked muzzle; and his smell is the most delicate sense the animal possesses, and the best of his resources. The tongue is covered with very rough papillæ. The ears have the power of closing, and turn upwards and backwards by means of three longitudinal folds, and are brought down by transverse folds, much more numerous, which cut the former at right angles. The movement, in both cases, is doubtless determined by a particular muscular apparatus.

An individual opossum, which is referred to in the above description, was fed with raw meat and soaked bread. He lapped in drinking; but was seen to receive in his mouth the water which fell drop by drop from the top of his cage; and whenever occasion offered, he repeated the same exercise, and appeared to find much pleasure in it. The seat of feeling seemed to be principally in the feet, which are covered with a very fine skin, and are furnished with very delicate tubercles, the forms and relations of which are too complicated for description.

In its wild state the opossum scoops out for himself a burrow near the bushes in the neighbourhood of habitations. He sleeps during the day, in which he sees but badly; but by night he is abroad to seek his food. He mounts the trees, penetrates into the poultry yards, attacks the hens and small birds, sucks their blood, devours their eggs, and when he is satisfied, returns to conceal himself at the bottom of his retreat. He often contents himself with reptiles and insects, and will even eat fruit. With habits of life analogous to those of the fox and the pole-cat, he is much less cruel and sanguinary; nor is he so well furnished as they with the means of defence. It has been already stated that he runs but badly; and though the mouth is extremely large and well armed, it wants force. The opossum is, besides, a stupid animal, and without that intelligence which might serve him against his enemies. He endeavours to bite the stick that strikes him, but not the arm that directs it; differing in this respect from most other mammalia, which, by a very remarkable act of intelligence, distinguish the person who aims the blow from the instrument which strikes, and attack the former. It appears that his principal means of defence consist in an abominable odour which he emits when in danger, and which M. de Azara, who in the assertion speaks from his own experience, declares that it requires a great effort of reason to support.

The peculiarity of construction of this and other marsupial animals occasioned the first describers of them to be considered rather as inventors than as trustworthy witnesses, and it was a considerable time before they were correctly represented. Even Buffon, though learnedly and very elaborately exposing the error of other writers with respect to this singular animal, or rather class of animals, has given a very inaccurate description of it, confounding the opossum of Virginia and kangaroo of New Holland; but giving for the former a figure unlike either, though between both.

ly. This bag, if we may so call it, being one of the most extraordinary things in natural history, requires a more minute description. Under the belly of the female is a kind of slit or opening, of about three inches long; this opening is composed of a skin, which makes a bag internally, that is covered on the inside with hair, and in this bag are the teats of the female; and into it the young, when brought forth, retire either to suckle or to escape from danger. This bag has a power of opening and shutting, at the will of the animal; and this is performed by means of several muscles, and two bones, that are fitted for this purpose, and that are peculiar to this animal only. These bones are placed before the *os pubis*, to which they are joined at the base; they are about two inches long, and grow smaller and smaller to their extremities. These support the muscles that serve to open the bag, and give them a fixture. To these muscles there are antagonists, that serve in the same manner to shut the bag; and this they perform so exactly, that in the living animal the opening can scarcely be discerned, except when the sides are forcibly drawn asunder. The inside of this bag is furnished with glands that exude a musky substance, which communicates to the flesh of the animal, and renders it unfit to be eaten. It is not to be supposed that this is the place where the young are conceived, as some have been led to imagine; for the opossum has another womb, like that of the generality of animals, in which generation is performed in the ordinary manner. The bag we have been describing may rather be considered as a supplemental womb. In the real womb, the little animal is partly brought to perfection; in the ordinary one, it receives a kind of additional incubation; and acquires at last strength enough to follow the dam wherever she goes. We have many reasons to suppose that the young of this animal are all brought forth prematurely, or before they have acquired that degree of perfection which is common in other quadrupeds. The little ones, when first produced, are in a manner but half completed; and some travellers assert, that they are at that time not much larger than flies. We are assured also, that immediately on quitting the real womb they creep into the false one; where they continue fixed to the teat, until they have strength sufficient to venture once more into the open air, and share the fatigues of the parent. Ulloa assures us, that he has found five of these little creatures hidden in the belly of the dam three days after she was dead, still alive, and all clinging to the teat with great avidity. It is probable, therefore, that upon their first entering the false womb, they seldom stir out from thence; but when more advanced, they venture forth several times in the day, and at last seldom make use of their retreat, except in cases of necessity or danger. Travellers are not agreed in their accounts of the time which these animals take to continue in the false womb; some assure us they remain there for several weeks; and others, more precisely, mention a month. During this period of strange gestation there is no difficulty in opening the bag in which they are concealed; they may be reckoned, examined, and handled, without much inconvenience; for they keep fixed to the teat, and cling there as firm as if they made a part of the body of the animal that bears them. When they are grown stronger, they drop from the teat into the bag in which they are contained; and at last find their way out, in search of more copious subsistence. Still, however, the false belly serves them for a retreat, either when they want to sleep or to suckle, or when they are pursued by an enemy. The dam, on such occasions, opens her bag to receive them, which they enter,

> ——————— Pars formidine turpi
> Scandunt rursus equum et nota conduntur in alvo.

The opossum, when on the ground, is a slow, helpless animal; the formation of its hands are alone sufficient to show its incapacity of running with any degree of swiftness; but, to counterbalance this inconvenience, it climbs trees with great ease and expedition.[1] It chiefly subsists upon birds; and hides among the leaves of the trees to seize them by surprise. It often also hangs by the tail, which is long and muscular; and in this situation, for hours together, with the head downwards, it keeps watching for its prey. If any lesser animal, which it is able to overcome, passes underneath, it drops upon it with deadly aim, and quickly devours it. By means of its tail, the opossum also slings from one tree to another, hunts insects, escapes its pursuers, and provides for its safety. It seems to be a creature that lives upon vegetables, as well as animal substances, roots, sugar-canes, the bark, and even the leaves of trees. It is easily tamed, but it is a disagreeable domestic, as well from its stupidity and figure as its scent, which, however fragrant in small quantities, fails not to be ungrateful when copiously supplied.

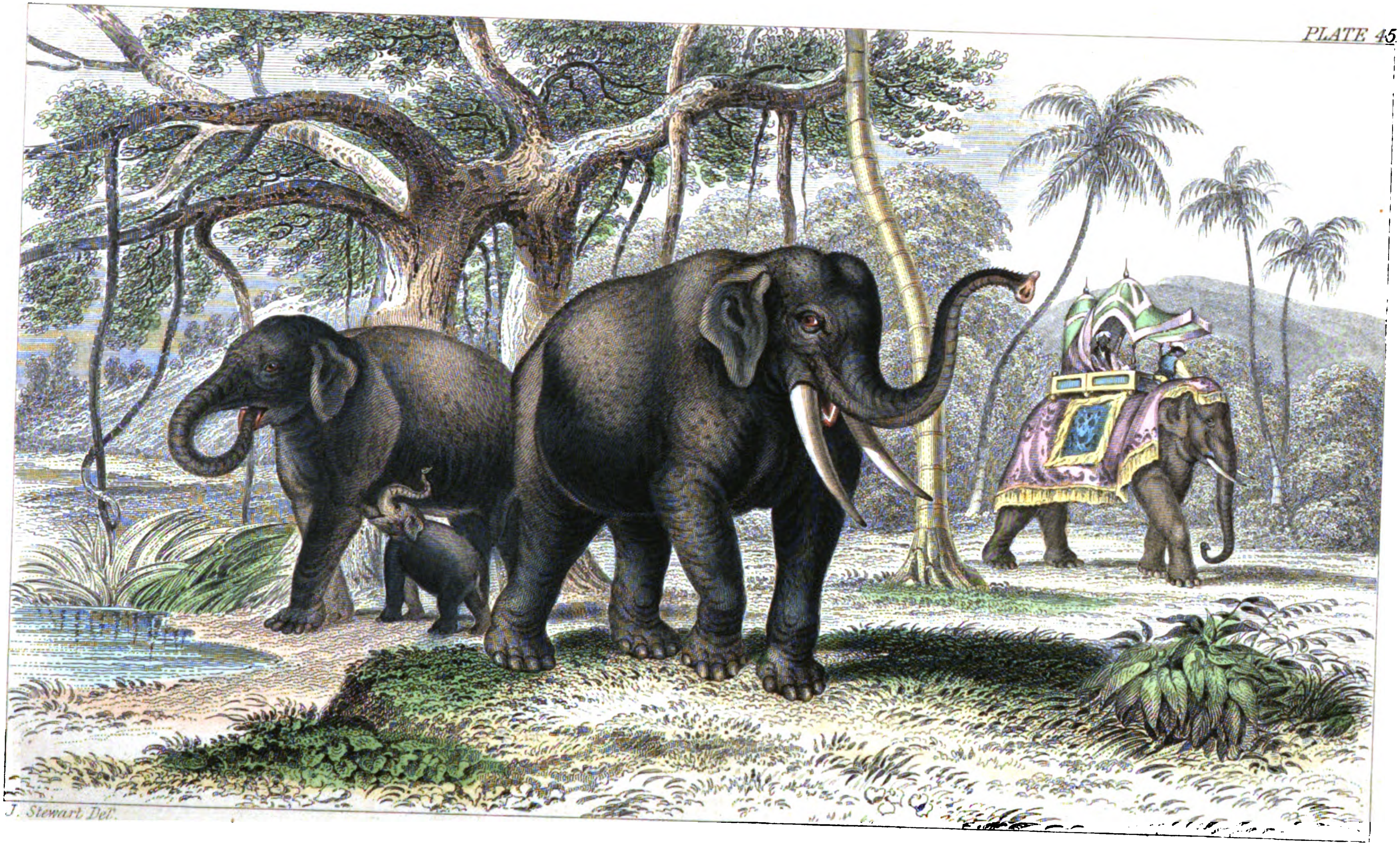
An animal greatly resembling the former,[2] is the MARMOSE, which is found in the same continent. It seems only to differ in size, being less; and, instead of a bag to receive its young, has only two longitudinal folds near the thighs, within which the young, which

---

[1] Buffon, vol. xxi. p. 174.

[2] Buffon, vol. xxi. p. 212.

PLATE 45



J. Stewart Del.

J. Bishop Sc.

ASIATIC ELEPHANT. MALE, FEMALE AND YOUNG.

CAPARISONED ELEPHANT, WITH HOWDAH IN THE DISTANCE.

Blackie & Son Glasgow, Edinburgh & London

are prematurely brought forth, as in the last instance, continue to suckle. The young of these, when first produced, are not above the size of a bean; but continue sticking to the teat, until they have arrived at greater maturity.

The CAYOPOLIN is somewhat larger than the former, and a good deal resembling it in habits and figure, except that its snout is more pointed, its tail longer in proportion, and its colour different, being of an ash, somewhat inclining to yellow; however, I should suppose it to be only a variety of the former.

To this number we may add the PHILANGER, so called by Mr Buffon; a good deal resembling the former, but distinguished by the fashion of its hinder hands; the thumb and forefinger being joined together, except at the extremities.[1] This animal is about the size of a rat, and has, accordingly, by some, been called the RAT OF SURINAM.

The last animal of this class is called, by Mr Buffon, the TARSIER. This extraordinary little animal resembles the former, in having four hands, and a long tail: but it differs very much in the extreme length of its hinder legs, which are longer than the rest of its whole body. The bones of that part of the foot called the *tarsus*, are likewise so very long, that from thence the animal has received its name: the tail is naked in the middle, and hairy only at both extremities; its hair is woolly, soft, and of a deep ash-colour. As to the rest, it is unknown from what country this animal was brought; but the naturalist from whom we have its description, supposes it to be a native of America.

From this general description of four-handed animals, we perceive what few advantages the brute creation derive from those organs, that, in man, are employed to so many great and useful purposes. The being able to pluck their food from the trees, the capacity of clinging among the branches, and at most of converting one of those branches, into a weapon of offence, are the highest stretches of their sagacity, and the only use their hands have hitherto been employed in; and yet some superficial men have asserted, that the hands alone are sufficient to vindicate the dominion of mankind over other animals; and that much of his boasted reason, is nothing more than the result of his happier conformation: however, were this so, an ape or a monkey would, in some instances, be more rational than we; their fingers are smaller, and, in some of them, more finely formed than ours. To what a variety of purposes might they not be employed, if their powers were properly exerted! Those works which we, from the largeness of our fingers, are obliged to go clumsily about, one of these could very easily perform with the utmost exactness; and if the fineness of the hand assisted reason, an ape would be one of the most reasonable beings in the creation. But these admirably formed machines, are almost useless both to mankind and themselves; and contribute little more to the happiness of animal life than the paws of the lowest quadruped. They are supplied, indeed, with the organs; but they want the mind to put them into action: it is that reasoning principle alone, with which man has been endowed, that can adapt seemingly opposite causes to concur in the same general design; and even where the organs are deficient, that can supply their place, by the intervention of assisting instruments. Where reason prevails, we find that it scarcely matters what the organs are that give it the direction; the being furnished with that principle still goes forward steadily, and uniformly successful; breaks through exery obstacle, and becomes master of every enterpriso. I have seen a man without hands or legs convert, by practice, his very stumps to the most convenient purposes; and with these clumsy instruments perform the most astonishing feats of dexterity. We may, therefore, conclude that it is the mind alone that gives a master to the creation; and that, if a bear or a horse were endowed with the same intellects that have been given to man, the hardness of a hoof, or the awkwardness of a paw, would be no obstacle to their advancement in the arts of dominion, or of social felicity.

CHAP. II.

OF THE ELEPHANT.

HAVING gono through the description of those quadrupeds that, by resembling each other in some striking particular, admit of being grouped together, and considered under one point of view, we now come to those insulated sorts that bear no similitude with the rest, and that to be distinctly described must be separately considered.

The foremost of these, and in every respect the noblest quadruped in nature, is the Elephant, not less remarkable for its size than its docility and understanding. All historians concur in giving it the character of the most sagacious animal next to man; and yet, were we to take our idea of its capacity from its outward appearance, we should be led to conceive very meanly of its abilities. The elephant, at first view, presents the spectator with an enormous mass of flesh that seems scarcely animated. Its huge body covered with a callous hide, without hair; its large mis-shapen legs, that seem scarcely formed for motion; its little eyes, large ears, and long trunk; all give it an air of extreme stupidity. But our prejudices will soon subside when we come to examine its history; they will even serve to increase our surprise, when we consider the various advantages it derives from so clumsy a conformation.

---

[1] It was in consequence of this union that these mamalia received the name of phalangers, from Buffon and Daubenton. It was a remarkable character at the epoch in which those writers flourished, and they named it from the only species then known to exhibit it. Since that period, however, it has been found in many other genera. These animals live almost continually in trees, where they subsist on fruits and insects. They are slow in their movements, and emit an unpleasant odour, which proceeds from a liquor secreted in a gland observable near the anus. The phalangers are found in the Moluccas, New Holland, and Van Dieman's Land.

The elephant is seen from seven to no less than fifteen feet high.[1] Whatever care we take to imagine a large animal before-hand, yet the first sight of this huge creature never fails to strike us with astonishment, and in some measure to exceed our idea. Having been used to smaller animals, we have scarcely any conception of its magnitude; for a moving column of flesh fourteen feet high, is an object so utterly different from those we are constantly presented with, that to be conceived it must be actually seen. Such, I own, were the suggestions that naturally arose to me when I first saw this animal, and yet for the sight of which I had taken care to prepare my imagination. I found my ideas fall as short of its real size as they did of its real figure; neither the pictures I had seen, nor the descriptions I had read, giving me adequate conceptions of either.

It would, therefore, be impossible to give an idea of this animal's figure by a description; which, even assisted by the art of the engraver, will but confusedly represent the original. In general, it may be observed, that the forehead is very high and rising, the ears very large and dependent, the eyes extremely small, the proboscis or trunk long, the body round and full, the back rising in an arch, and the whole animal short in proportion to its height. The feet are round at the bottom; on each foot there are five flat horny risings, which seem to be the extremities of the toes, but do not appear outwardly. The hide is without hair, full of scratches and scars, which it receives in its passage through thick woods and thorny places. At the end of the tail there is a tuft of hair, a foot and a half long. The female is less than the male, and the udder is between the fore-legs. But a more accurate, as well as a more entertaining description of the parts, will naturally occur in the history of their uses.[2]

Of all quadrupeds, the elephant is the strongest, as well as the largest; and yet, in a state of nature, it is neither fierce nor formidable.[3] Mild, peaceful, and brave, it never abuses its power or its strength, and only uses its force for its own protection, or that of its community. In its native deserts, the elephant is seldom seen alone, but appears to be a social, friendly creature. The oldest of the company conducts the band; that which is next in seniority brings up the rear. The young, the weak, and the sickly, fall into the centre; while the females carry their young, and keep them from falling by means of their trunks. They maintain this order only in dangerous marches, or when they desire to feed in cultivated grounds; they move with less precaution in the forests and solitudes; but without ever separating, or removing so far asunder as to be incapable of lending each other any requisite assistance. Nothing can be more formidable than a drove of elephants, as they appear at a distance in an African landscape; wherever they march, the forests seem to fall before them; in their passage, they bear down the branches upon which they feed; and if they enter into an inclosure, they destroy all the labours of the husbandman in a very short time. Their invasions are the more disagreeable, as there is no means of repelling them; since it would require a small army to attack the whole drove when united. It now and then happens that one or two are found lingering behind the rest, and it is against these that the art and force of the hunters are united; but an attempt to molest the whole body would certainly be fatal. They go forward directly against him who offers the insult, strike him with their tusks, seize him with their trunks, fling him into the air, and then trample him to pieces under their feet. But they are thus dreadful only when offended, and do no manner of personal injury when suffered to feed without interruption. It is even said that they are mindful of injuries received; and when once molested by man seek all occasions for the future to be revenged; they smell him with their long trunks at a distance; follow him with all their speed upon the scent; and though slow to appearance, they are soon able to come up with and destroy him.

---

[1] Elephants very rarely exceed ten feet in height. Seven feet and upwards is the East India Company's standard for serviceable elephants, measured at the shoulder, as horses are. A large elephant weighs from six to seven thousand pounds.

[2] There are two species of elephant—the Asiatic and African. (See both represented in Plate XIV.; fig. 1. is the Asiatic; fig. 2. the African.) The head of the elephant of Africa is smaller, more elongated, and less irregular in its contour than that of the Asiatic species. The summit is rounded instead of being divided by a central longitudinal depression. But the most striking feature in the African elephant is the enormous size of his ears, which extend over his shoulders, and when agitated to and fro, beat the air, with a violence and noise equal to that produced by the flapping of the wings of the condor or other huge bird. On the thick integument which invests the disproportionately small foot of the elephant five hoofs may be observed on the fore foot in both species, whilst on the hind foot four hoofs are observable in the Asiatic elephant and three only in the African. We should be mistaken, however, in supposing that the number of toes strictly corresponded to these outward indications; for in both species, when the skin and flesh are removed and the bony framework is exposed, these huge productions of nature are seen to have been constructed on the same plan, and the ultimate divisions of all the four extremities are seen in the skeleton to be into five distinct parts or toes. It has been observed that the extremity of the proboscis in the African elephant is better constructed as a prehensile organ, and that he seizes thin substances with greater ease and effect than his eastern relative. The tail in the African species is shorter by half its length than in the Asiatic. These characters are open to superficial inspection, and may be readily seized by the youngest student of zoology; but the most important specific distinction requires a closer investigation: it is derived from the differences presented by the worn-down surfaces of the grinding teeth;—those of the Asiatic elephant presenting parallel transverse wavy ridges, while the African's grinders are marked by transverse lozenge-shaped ridges. The degree of difference, therefore, between those two animals, when strictly considered with reference to the modern methods in zoology, is even greater than usually separates species such as the dog and wolf; and is equivalent rather to that which distinguishes the dog from the hyæna. A distinct generic name (*Loxodonte*) has therefore been proposed for the African elephant.

[3] I have extracted the greatest part of this description from Mr Buffon. Where I add I mark with commas, "thus."—*Goldsmith.*

In their natural state they delight to live along the sides of rivers, to keep in the deepest vales, to refresh themselves in the most shady forests and watery places. They cannot live far from the water; and they always disturb it before they drink. They often fill their trunk with it either to cool that organ, or to divert themselves by spurting it out like a fountain.[1] They are equally distressed by the extremes of heat and cold; and to avoid the former, they frequently take shelter in the most obscure recesses of the forest, or often plunge into the water, and even swim from the continent into islands some leagues distant from the shore.

Their chief food is of the vegetable kind, for they lothe all kind of animal diet. When one among their number happens to light upon a spot of good pasture, he calls the rest, and invites them to share in the entertainment; but it must be very copious pasture indeed that can supply the necessities of the whole band. As with their broad and heavy feet they sink deep wherever they go, they destroy much more than they devour; so that they are frequently obliged to change their quarters, and to migrate from one country to another. The Indians and negroes, who are often incommoded by such visitants, do all they can to keep them away, making loud noises, and large fires round their cultivated grounds: but these precautions do not always succeed; the elephants often break through their fences, destroy their whole harvest, and overturn their little habitations. When they have satisfied themselves, and trod down or devoured whatever lay in their way, they then retreat into the woods in the same orderly manner in which they made their irruption.

Such are the habits of this animal, considered in a social light; and if we regard it as an individual, we shall find its powers still more extraordinary. With a very awkward appearance,[2] it possesses all the senses in great perfection, and is capable of applying them to more useful purposes than any other quadruped. The elephant, as we observed, has very small eyes, when compared to the enormous bulk of its body. But though their minuteness may at first sight appear deformed, yet, when we come to examine them, they are seen to exhibit a variety of expression, and to discover the various sensations with which it moves. It turns them with attention and friendship to its master: it seems to reflect and deliberate; and as its passions slowly succeed each other, their various workings are distinctly seen.

---

[1] The trunk also serves to convey water to the mouth.

[2] Notwithstanding the massiveness of his frame, the elephant is not without a certain degree of lightness in his motions. He has a tolerable quick trot, and easily overtakes a man at full speed; but as he cannot turn rapidly, one may escape by turning suddenly to one side. Being specifically lighter than water, he easily swims; and his motions in that element are of the most free and lively description. Every one who enjoyed the sight of the elephant sporting in his bath at the Zoological Gardens during the summer of last year must acknowledge the gratification and surprise excited by the ease and variety of his actions. Notwithstanding, however, the liberal space allowed for his paddock and pond, our sagacious animal seemed not contented until he had rendered his domain still more analogous to the favourite haunts of his species in their native clime. This he effected by forming a miniature swamp in the immediate proximity of his pond, pumping up with his proboscis repeated quantities of water, and treading it into the soil, which thus was soon converted into a mud bath of a few feet in depth. In this he seemed peculiarly delighted, rubbing and rolling himself about, and expressing his gratification at the same time by uttering peculiar shrill guttural notes, and flapping his ears. In a state of nature this species prefers the banks of rivers, for heat as well as cold annoys him. He is under a constant necessity of moistening his hard and rough skin, which otherwise is so apt to be excoriated; and he not only waters it, but throws over it dust, grass, straw, &c.

Although this integument is so thick, it appears nevertheless to be extremely sensible, especially about the face, the legs, and the under parts of the neck and body. We have sometimes seen the young elephant above mentioned, in the Society's menagerie, take a small branch in his trunk, and switch away the flies the moment they alighted on any of those parts.—*Zoological Magazine.*

The elephant is not less remarkable for the excellence of its hearing. Its ears are extremely large, and greater in proportion than even those of an ass.[1] They are usually dependent; but it can readily raise and move them. They serve also to wipe its eyes, and to protect them against the dust and flies that might otherwise incommode them. It appears delighted with music, and very readily learns to beat time, to move in measure, and even to join its voice to the sound of the drum and the trumpet.

This animal's sense of smelling is not only exquisite, but it is in a great measure pleased with the same odours that delight mankind.[2] The elephant gathers flowers with great pleasure and attention; it picks them up one by one, unites them into a nose-gay, and seems charmed with the perfume. The orange-flower seems to be particularly grateful, both to its sense of taste and smelling; it strips the tree of all its verdure, and eats every part of it, even to the branches themselves. It seeks in the meadows the most odoriferous plants to feed upon; and in the woods it prefers the cocoa, the banana, the palm, and the sago tree, to all others. As the shoots of these are tender, and filled with pith, it eats not only the leaves and the fruits, but even the branches, the trunk, and the whole plant to the very roots.

But it is in the sense of touching that this animal excels all others of the brute creation, and perhaps even man himself. The organ of this sense lies wholly in the trunk, which is an instrument peculiar to this animal, and that serves it for all the purposes of a hand. The trunk is, properly speaking, *only the* snout lengthened out to a great extent, hollow like a pipe, and ending in two openings or nostrils like those of a hog. An elephant of fourteen feet high has the trunk about eight feet long, and five feet and a half in *circum-*

---

[1] The most obvious distinction, as we have already stated, between the Asiatic and African elephants, is the enormous ears of the latter, which are so large as to be employed at the Cape of Good Hope as mats to carry the sick, &c.

[2] The sense of smell is very wonderful, and is no doubt the one by which the course of the animal is chiefly guided in those places where sight would be useless, and hearing of little more avail, on account of the rustling that itself must make. Thick as the hide of the elephant is, it is far from invulnerable. The insects of the jungles give it a great deal of annoyance, and put it to many shifts in order to get rid of them. Indeed, when left to itself, and where it has plenty of food and water, the hide of the elephant is soft, and it is dry and chapped in confinement, only because the animal does not get proper food, or enough of exercise to promote digestion. With the exception of the human hand, and the express organs of feeling in animals that have to grope for their way and their food, there are few organs in nature in which the sense of touch appears to be more acute and delicate than in the trunk of the elephant, especially in that part of it which serves as a hand.

Notwithstanding its great strength, and the formidable weapons with which nature has furnished it, the elephant is a harmless, and even a retiring animal; and, unless when alarmed for its own safety, it wages war upon no other living creature. The extensive and thick forests are its chief abode; and the places of India where it is most abundant are the moist forests in the south-east of Bengal, and some parts of the weastern Ghauts, but more especially the former. The forests on the Tippera hills, on the south of the Silhet district, have long been the place where the principal continental supply of elephants has been obtained; and there they are still numerous, being found in herds of about a hundred in number. They are, like many of the other animals that live entirely upon vegetables, gregarious; and the herd are generally found to follow the oldest pair as leaders, and to go readily wherever they lead the way. In their marches through those forests, tangled as they are with underwood, sight would be of little avail; and therefore their means of communication are scent and sound. Food, friends, and foes, appear to be detected with great certainty, and at a considerable distance, by the former; and the latter also admits of considerable variety. An elephant has three cries. The one is rather clear and shrill—a trumpet note, produced wholly by the trunk, and emitted when the animal is in good humour, and all is safe. The second is a growl or groan, issuing from the mouth, and is the cry of hunger, or an intimation to the rest when one has come upon an abundant supply of food; the third sound is loud as the roaring of the lion, and is the war-cry by which the animal prefaces his own hostilities, or calls his associates to his aid. They are seldom found far from each other, unless in the case of males that are expatriated, as is the case with deer and some other animals; and those often quit the forest, and are caught by using three or four tame females as a decoy. Even alone, in these cases, the beasts of prey—even the tiger, notwithstanding his agility and strength—will hardly venture to attack the elephant. The male receives him on his tusks, tosses him into the air, and stands prepared to stamp his fatal foot upon him, the instant that he touches the ground. The female elephant has no tusks upon which to receive an enemy; but she has the art to fall upon him, and crush him by her weight.

In their native forests, where they are in herds, the elephants are invincible to all enemies but man. If one gives an alarm, others hasten to the spot, and where they act in concert, the carnivorous animals keep their distance. In those places man is the only inhabitant of the earth by whom they can be subdued; and he owes his superiority chiefly to an element which the lower animals have never been able to engage in their service. Man, even in his most savage and uncultivated state, rubs one piece of wood against another, till one or both be ignited; he applies the match, so lighted, to a bundle of sticks, or to the reeds, brushwood, or grass, and the stoutest and most daring animals own his sway, and shrink from this the symbol of his dominion. When we reflect on the power and the security which this single and simple operation of the lighting of a fire gives to a man in those parts of the world that are infested by ferocious animals, we cannot help being struck at the vast superiority which the possession, even of the lowest degree of reason, has over the perfection of mere animal courage and strength."—*Picture of India*, 2 vols. 8vo. 1830.

ference at the mouth where it is thickest. It is hollow along, but with a partition running from one end of it to the other; so that though outwardly it appears like a single pipe, it is inwardly divided into two. This fleshy tube is composed of nerves and muscles, covered with a proper skin of a blackish colour, like that of the rest of the body. It is capable of being moved in every direction, of being lengthened and shortened, of being bent and straightened; so pliant as to embrace any body it is applied to, and yet so strong that nothing can be torn from the gripe. To aid the force of this grasp, there are several little eminences, like a caterpillar's feet, on the underside of this instrument, which without doubt contribute to the sensibility of the touch, as well as to the firmness of the hold. Through this trunk the animal breathes, drinks, and smells, as through a tube; and at the very point of it, just above the nostrils, there is an extension of the skin, about five inches long, in the form of a finger, and which in fact answers all the purposes of one; for with the rest of the extremity of the trunk, it is capable of assuming different forms at will, and consequently of being adapted to the minutest objects. By means of this, the elephant can take a pin from the ground, untie the knots of a rope, unlock a door, and even write with a pen. "I have myself seen," says Ælian, "an elephant writing Latin characters on a board, in a very orderly manner, his keeper only showing him the figure of each letter. While thus employed, the eyes might be observed studiously cast down upon the writing, and exhibiting an appearance of great skill and erudition." It sometimes happens that the object is too large for the trunk to grasp; in such a case the elephant makes use of another expedient, as admirable as any of the former. It applies the extremity of the trunk to the surface of the object, and sucking up its breath, lifts and sustains such a weight as the air in that case is capable of keeping suspended. In this manner this instrument is useful in most of the purposes of life; it is an organ of smelling,[1] of touching, and of suction; it not only provides for the animal's necessities and comforts, but it also serves for its ornament and defence.

But though the elephant be thus admirably supplied by its trunk, yet with respect to the rest of its conformation, it is unwieldy and helpless. The neck is so short that it can scarcely turn the head, and must wheel round in order to discover an enemy from behind. The hunters that attack it upon that quarter generally thus escape the effects of its indignation; and find time to renew their assaults while the elephant is turning to face them. The legs are, indeed, not so inflexible as the neck, yet they are very stiff, and bend not without difficulty. Those before seem to be longer than the hinder; but upon being measured, are found to be something shorter. The joints, by which they bend, are nearly in the middle, like the knee of a man; and the great bulk which they are to support, makes their flexure ungainly. While the elephant is young, it bends the legs to lie down or to rise; but when it grows old, or sickly, this is not performed without human assistance, and it becomes, consequently, so inconvenient, that the animal chooses to sleep standing. The feet upon which these massy columns are supported, form a base scarcely broader than the legs they sustain. They are divided into five toes, which are covered beneath the skin, and none of which appear to the eye; a kind of protuberance like claws are only observed, which vary in number from three to five. The apparent claws vary; the internal toes are constantly the same. The sole of the foot is furnished with a skin as thick and hard as horn, and which completely covers the whole under-part of the foot.

---

[1] Cuvier considers that the trunk is not in itself an organ of smell, but that the sense of smell is confined to that part of the nostrils which is inclosed in the bones of the head. As an organ of touch, the proboscis of the elephant is exquisitely fine. Elephants sometimes go blind; and under that privation, the poor animal can not only collect its food, and discriminate as to its quality, by this wonderful instrument, but can travel without much difficulty, over unequal ground, avoiding lumps and hollows, and stepping over ditches. The creature, under such circumstances, rarely touches the ground with its trunk; but projecting it forward as far as possible, lets the finger, which is curled inward to protect the nostrils, skim along the surface, to the inequalities of which this organ adjusts itself with wonderful exactness. The great care of the elephant, whether he be in a state of nature, or under the control of man is, invariably to put his trunk out of harm, as far as he can, when any danger presents itself. If he is attacked by a tiger, or any other wild animal, he carries his trunk as high as he can in the air, and if this delicate organ be in the slightest degree injured, the elephant becomes wild with rage and terror. He is even afraid of a dead tiger, and carefully puts his trunk out of reach. The instinct by which the creature defends and preserves this precious instrument, is in proportion to its paramount importance. Mr Williamson saw an elephant whose trunk had been cut through with a bill-hook; and though the wound was healed, the animal was perfectly helpless—unable to supply its own food, and incapable even of travelling without danger. He was fed with bundles of grass which were put into his mouth; had he been in a state of nature, he must have perished. An affecting example of the instinct with which the elephant preserves his trunk, is exhibited in the death of the poor animal who was burned at Dublin. The author of the anatomical account says—"Doubtless the elephant's care to preserve the proboscis was great: for when we dissected him, *we found it thrust near two feet into a very hard ground;* upon which account we thought it had been burned, till the head was divided from the body, and then we found it kept fast to the ground by the proboscis." The care with which the elephant endeavours to put his trunk out of danger, makes him extremely cautious of using it as a weapon. He rarely strikes with it; though he will frequently throw clods and stones with it at objects which he dislikes. Elephants often thus attack hogs, casting their missiles with tolerable force and precision.

To the rest of the elephant's encumbrances may be added its enormous tusks, which are unserviceable for chewing, and are only weapons of defence. These, as the animal grows old, become so heavy, that it is sometimes obliged to make holes in the walls of its stall to rest them in, and ease itself of the fatigue of their support. It is well known to what an amazing size these tusks grow; they are two in number, proceeding from the upper jaw, and are sometimes found above six feet long. Some have supposed them to be rather the horns than the teeth of this animal; but besides their greater similitude to bone than to horn, they have been indisputably found to grow from the upper jaw, and not from the frontal bones, as some have thought proper to assert.[1] Some also have asserted, that these tusks are shed in the same manner as the stag sheds its horns; but it is very probable, from their solid consistence, and from their accidental defects, which often appears to be the effect of a slow decay, that they are as fixed as the teeth of other animals are generally found to be. Certain it is, that the elephant never sheds them in a domestic state, but keeps them till they become inconvenient and cumbersome to the last degree. An account of the uses to which these teeth are applied, and the manner of choosing the best of ivory, belongs rather to a history of the arts than of nature.

This animal is equally singular in other parts of its conformation; the lips and the tongue in other creatures serve to suck up and direct their drink or their food; but in the elephant they are totally inconvenient for such purposes; and it not only gathers its food with its trunk, but supplies itself with water by the same means. When it eats hay, as I have seen it frequently, it takes up a small wisp of it with the trunk, turns and shapes it with that instrument for some time, and then directs it into the mouth, where it is chewed by the great grinding teeth, that are large in proportion to the bulk of the animal. This packet, when chewed, is swallowed, and never ruminated again, as in cows or sheep, the stomach and intestines of this creature more resembling those of a horse. Its manner of drinking is equally extraordinary. For this purpose the elephant dips the end of its trunk into the water, and sucks up just as much as fills that great fleshy tube completely. It then lifts up its head with the trunk full, and turning the point into its mouth, as if it intended to swallow trunk and all, it drives the point below the opening of the windpipe. The trunk being in this position, and still full of water, the elephant then blows strongly into it at the other end, which forces the water it contains into the throat; down which it is heard to pour with a loud gurgling noise, which continues till the whole is blown down. From this manner of drinking some have been led into an opinion that the young elephant sucks with its trunk, and not with its mouth; this, however, is a fact which no traveller has hitherto had an opportunity of seeing, and it must be referred to some future accident to determine.[2]

The hide of the elephant is as remarkable as any other part. It is not covered over with hair, as in the generality of quadrupeds, but is nearly bare. Here and there indeed a few bristles are seen growing in the scars and wrinkles of the body, but very thinly scattered over the rest of the skin; but in general the head is dry, rough, and wrinkled, and resembling more the bark of an old tree than the skin of an animal. This grows thicker every year; and by a constant addition of substance, it at length contracts that disorder well known by the name of elephantiasis, or Arabian leprosy; a disease to which man, as well as the elephant, is often subject. In order to prevent this, the Indians rub the elephant with oil, and frequently bathe it, to preserve its pliancy. To the inconveniences of this disorder is added another, arising from the great sensibility of those parts that are not callous. Upon these the flies settle in great abundance, and torment this animal unceasingly; to remedy which, the elephant tries all its arts; using not only its tail and trunk in the natural manner to keep them off, but even takes the branch of a tree, or a bundle of hay, to strike them off with. When this fails, it often gathers up the dust with its trunk, and thus covers all the sensible places. In this manner it has been seen to dust itself several times a-day, and particularly upon leaving the bath. Water is as necessary to this animal as food itself. When in a state of nature, the elephant rarely quits the bank of the river, and often stands in water up to the belly. In a state of servitude, the Indians take equal care to provide a proper supply; they wash it with great address; they give it all the conveniences for lending assistance to itself; they smooth the skin with a pumice-stone, and then rub it over with oils, essences, and odours.

---

[1] See Mr Daubenton's description of the skeleton of this animal.

[2] The young elephant, it is now known, does not suck by the trunk, but by the mouth only, as in all other quadrupeds; during which the trunk of the young is thrown back over the head.

It is not to be wondered at, that an animal furnished with so many various advantages, both of strength, sagacity, and obedience, should be taken into the service of man. We accordingly find that the elephant, from time immemorial, has been employed either for the purposes of labour, of war, or of ostentation; to increase the grandeur of eastern princes, or to extend their dominions. We have hitherto been describing this animal in its natural state; we now come to consider it in a different view, as taken from the forest, and reduced to human obedience. We are now to behold this brave harmless creature as learning a lesson from mankind, and instructed by him in all the arts of war, massacre, and devastation. We are now to behold this half-reasoning animal led into the field of battle, and wondering at those tumults and that madness which he is compelled to increase. The elephant is a native of Africa and Asia, being found neither in Europe nor America. In Africa he still retains his natural liberty. The savage inhabitants of that part of the world, instead of attempting to subdue this powerful creature to their necessities, are happy in being able to protect themselves from his fury. Formerly, indeed, during the splendour of the Carthaginian empire, elephants were used in their wars; but this was only a transitory gleam of human power in that part of the globe; the natives of Africa have long since degenerated, and the elephant is only known among them from his devastations. However, there are no elephants in the northern parts of Africa at present, there being none found on this side of Mount Atlas. It is beyond the river Senegal that they are to be met with in great numbers, and so down to the Cape of Good Hope, as well as in the heart of the country. In this extensive region they appear to be more numerous than in any other part of the world. They are there less fearful of man; less retired into the heart of the forests, they seem to be sensible of his impotence and ignorance; and often come down to ravage his little labours. They treat him with the same haughty disdain which they show to other animals, and consider him as a mischievous little being, that fears to oppose them openly.

But although these animals are most plentiful in Africa, it is only in Asia that the greatest elephants are found, and rendered subservient to human command. In Africa, the largest do not exceed ten feet high; in Asia, they are found from ten to fifteen. Their price increases in proportion to their size; and when they exceed a certain bulk, like jewels, their value then rises as the fancy is pleased to estimate.[1]

The largest are entirely kept for the service of princes; and are maintained with the utmost magnificence, and at the greatest expense. The usual colour of the elephant is a dusky black, but some are said to be white; and the price of one of these is inestimable. Such a one is peculiarly appropriated for the monarch's own riding; he is kept in a palace, attended by the nobles, and almost adored by the people.[2] Some have said that these white elephants are larger than the rest;[3] others assert that they are less; and still others entirely doubt their existence.

As the art of war is but very little improved in Asia, there are few princes of the East who do not procure and maintain as many elephants as they are able, and place great confidence on their assistance in an engagement. For this purpose they are obliged to take them wild in their native forests, and tame them; for the elephant never breeds in a state of servitude. It is one of the most striking peculiarities in this extraordinary creature, that his generative powers totally fail when he comes under the dominion of man; as if he seemed unwilling to propagate a race of slaves to increase the pride of his conqueror. There is, perhaps, no other quadruped that will not breed in its own native climate, if indulged with a moderate share of freedom; and we know that many of them will copulate in every climate. The elephant alone has never been seen to breed; and though he has been reduced under the obedience of man for ages, the duration of pregnancy in the female[4] still remains a secret. Aristotle, indeed, asserts, that she goes two years with young ; that she continues to suckle her young for three years, and that she brings forth but one at a time ; but he does not inform us of the manner in which it was possible for him to have his information. From authorities equally doubtful, we learn, that the little one is about as large as a wild boar the instant it is brought forth ; that its tusks do not yet appear ; but that all the rest of its teeth are apparent ; that at the age of six months, it is as large as an ox, and its tusks pretty well grown ; and that it continues in this manner, for near thirty years, advancing to maturity. All this is doubtful ; but it is certain that, in order to recruit the numbers which are consumed in war, the princes of the East are every year obliged to send into the forests, and to use various methods to procure a fresh supply. Of all these numerous bands, there is not one that has not been originally wild ; nor one that has not been forced into a state of subjection. Men themselves are often content to propagate a race of slaves, that pass down in this wretched state through successive generations: but the elephant, under subjection, is unalterably barren ; perhaps from some physical causes, which are as yet unknown.[1]

---

[1] *The arrival of the first Elephant ever seen in England.* — Matthew Paris relates, that about the year 1255, an elephant was sent over to England as a grand present from the king of France to Henry III.; and states, that it was believed to be the first and only elephant ever seen in England, or even on this side the Alps; and that consequently the people flocked in great numbers to behold so great a novelty on its arrival. Among the Close Rolls one of about this date is extant, in which the sheriff of Kent is ordered to proceed to Dover in person to arrange in what manner the king's elephant might be most conveniently brought over; and to provide a ship, and other things necessary, to convey it; and directing that, if the king's mariners judged it practicable, it should be brought to London by water. Another order was shortly after issued to the sheriffs of London, commanding them to cause to be built, without delay, in the Tower of London, a house, forty feet in length and twenty feet in breadth, for the king's elephant; and directing that it should be so strongly constructed that, whenever there should be need, it might be adapted to, and used for, other purposes.

[2] P. Vincent Marie. [3] P. Tachard.

[4] Multis persuasum est elephantem non brutorum sed hominum more coire. Quod retro mingit non dubitatur. Sed ipse vidi marem hujusce speciei, in nostri regis stabulis, super fæmellam itidem inclusam quadrupedum more silientem, pene paululum incurvato sed sufficienter recto.

The Indian princes having vainly endeavoured to multiply the breed of elephants, like that of other animals, have been at last content to separate the males from the females, to prevent those accesses of desire, which debilitated without multiplying the species.[2] In order to take them wild in the woods, a spot of ground is fixed upon, which is surrounded with a strong palisade. This is made of the thickest and the strongest trees; and strengthened by cross bars, which give firmness to the whole. The posts are fixed at such distances from each other that a man can easily pass between them; there being only one great passage left open, through which an elephant can easily come; and which is so contrived as to shut behind, as soon as the beast is entered. To draw him into this inclosure, it is necessary first to find him out in the woods; and a female elephant is conducted alone into the heart of the forest, where it is obliged by its keeper to cry out for the male. The male very readily answers the cry, and hastens to join her; which the keeper perceiving, obliges her to retreat, still repeating the same cry, until she leads the animal into the enclosure already described, which shuts the moment he is entered. Still, however, the female proceeds calling and inviting, while the male proceeds forward in the enclosure, which grows narrower all the way, and, until the poor animal finds himself completely shut up, without the power of either advancing or retreating; the female in the meantime being let out by a private way, which she has been previously accustomed to. The wild elephant, upon seeing himself entrapped in this manner, instantly attempts to use violence; and, upon seeing the hunters, all his former desires only turn to fury. In the meantime, the hunters, having fixed him with cords, attempt to soften his indignation, by throwing buckets of water upon him in great quantities, rubbing the body with leaves, and pouring oil down his ears. Soon after, two tame elephants are brought, a male and a female, that caress the indignant animal with their trunks; while they still continue pouring water to refresh it. At last a tame elephant is brought forward, of that number which is employed in instructing the new-comers, and an officer riding upon it, in order to show the late captive that it has nothing to fear. The hunters then open the enclosure; and while this creature leads the captive along, two more are joined on either side of it, and these compel it to submit. It is then tied by cords to a massy pillar, provided for that purpose, and suffered to remain in that position for about a day and a night, until its indignation be wholly subsided. The next day it begins to be somewhat submissive; and in a fortnight is completely tamed like the rest. The females are taken when accompanying the males; they often come into these enclosures, and they shortly after serve as decoys to the rest. But the method of taking the elephant differs, according to the abilities of the hunter; the negroes of Africa, who hunt this animal merely for its flesh, are content to take it in pit-falls; and often to pursue it in the defiles of a mountain, where it cannot easily turn, and so wound it from behind, till it falls.[1]

---

[1] The obscurity which formerly prevailed respecting the mode of reproduction of the elephant has been dissipated in a great measure by the accurate and assiduous observations of our countryman, Mr Corse. And it is a remarkable instance of the difficulty of eradicating a popular error or prejudice, that notwithstanding the circumstantial evidence and authentic description given by this gentleman relative to the above subject, it is still very generally believed that in a state of subjection the elephant is unalterably barren ; and that though it has been reduced under the dominion of man for ages, yet, as if it had a proper sense of its degraded condition, it refuses to increase the pride and power of its conquerors by propagating a race of slaves. This circumstance was adduced by Buffon as one of the most striking instances of the superiority of the elephant, in its moral condition, over other quadrupeds. Mr Corse, who resided for more than ten years at Tiperah, a province of Bengal, where herds of elephants are taken every season, and who for five years had the Company's elephant hunters entirely under his direction, has completely disproved these assertions. Twice during that period he succeeded in breeding from elephants in a state of captivity and servitude, and observes that this mode of supplying the Indian community with so useful an animal is abandoned only from its being more expensive than the ordinary method by the capture of the wild herds ; since the elephants, after being reduced by the process of training, require rest and high feeding to bring them into the requisite condition. In this way was ascertained the precise period of gestation in the elephant, which Mr Corse states to be twenty months and eighteen days. The young animal when born is 35½ inches high. It soon begins to nibble and suck the breast, pressing it with its trunk to make the milk flow more readily into its mouth while sucking. It has never been observed to use its proboscis in any other manner during this act, but invariably seized the nipple with the side of its mouth. At this period it is a common practice with the elephant attendants to raise a small mound of earth, about six or eight inches high, for the young one to stand on, and thus to save the mother the trouble of bending her body every time she gives suck; for she has never been observed to lie down for that purpose. The nipples are two in number, and are situated between the fore legs. It is remarkable that the elephant, although having but one young, has by no means a strong affection for it: instances have occurred of the mother leaving her offspring and escaping into the woods. If a wild elephant happens to be separated from her young for only two days, though giving suck, she never afterwards recognises or acknowledges it. "I have been much mortified," says Mr Corse, "at such unnatural conduct, particularly when it was evident the young elephant knew its dam, and by its plaintive cries and submissive approach solicited her assistance." During the first year the elephant grows eleven inches, and is three feet eleven inches high ; in the second he grows eight inches ; in the third six ; in the fourth year five inches ; about the same in the fifth year ; in the sixth year three inches and a half ; and in the seventh year two inches and a half,—measuring then six feet four inches in height. During the succeeding ten years the growth is comparatively slow. The male is longer in attaining his full growth than the female, seldom having acquired it before his twenty-sixth year.—*Zoological Magazine*.

[2] During rutting time, which occurs in the spring, the elephants often become extremely violent ; and it is believed, that at that period the larger males or *Goondahs* are driven from the herd. It is necessary that those which are domesticated should be kept low at that season ; but this does not always prove efficacious, and the animal is either turned out into the woods or destroyed, to prevent mischief. Three examples of this kind have occurred within a few years, in Europe. The first of them was in an elephant belonging to M. Garnier, which broke loose at Venice, and after having done much mischief, was destroyed by a cannon ball. Another elephant belonging to the same person was remarkable for its docility, and in its journeys from town to town was conducted on foot by night, instead of being conveyed in a movable den. Sufficient time having elapsed during his stay at Geneva to suit his owner's convenience, he was to have been removed elsewhere ; but shortly previous to his departure he became irritable, although not refractory, and the journey was commenced. He had not, however, gone far from the city before he became ill-tempered to his keeper ; and the man, being fearful, ran away, pursued by the angry beast into Geneva, where he was at last enticed into an inclosure. Three ounces of Prussic acid in brandy were given to him, but no effect was produced, and three ounces of arsenic mixed with honey and sugar were next taken, but with as little result ; a second dose of the arsenic was offered ; but he refused it, and it was then determined to destroy him by shooting him with a cannon ball, which entered near the ear, and the animal, after tottering for a few minutes, fell down and died. The third instance occurred in London, in 1826, at Exeter Change. About six years before, the elephant first exhibited symptoms of that natural excitement which occurs for a short time annually amongst these animals. From year to year this increased, but never was of sufficient importance to give cause for fear till last Febru-

---

ary, when he became excessively violent: medicines were administered, for the purpose of removing this excitement, but without effect: he became very unmanageable, and, driving with his head against the strong posts forming the front of his den, broke them in such a manner as to render his confinement very uncertain, and to induce Mr Cross, his owner, to attempt his destruction. For this purpose arsenic was given in his oats, which he refused; and every subsequent endeavour to entice him to take food was futile, as he seemed to have some idea of the intended mischief, and throwing down whatever was offered to him, crushed it with his foot. At last it became necessary to shoot him, as all other attempts at his destruction entirely failed; but he was not destroyed till he had received 120 musket balls, and above an hour had been spent in the attack upon him.—*Encyclopedia Metropolitana.*

[1] Pliny, describing the manner of capturing elephants in India, says, "The hunter mounts on an elephant already tamed;—and when he meets with a wild one separated from the herd, he pursues it, and strikes it until it is so exhausted that he is able to leap from the one to the other, and thus to reduce the wild animal to obedience." This process is as summary as that which the Roman naturalist also notices as the practice of the Troglodytes, whom Diodorus Siculus by an expressive epithet describes as warring against the elephants. These are said to suspend themselves on the branches of trees under which the wild herd passes, and, slipping down over the crupper of a particular animal, to seize his tail with the one hand and ham-string him with the other. Although the elephant is destroyed by an experienced African marksman with much more precision than by this process of cutting his hams, he is certainly not reduced to obedience so quickly by the Indian hunters of the present day, as by those whom Pliny has described as bringing him into captivity. But the operation, however slow, is at least effective;—and the discipline does not require a constant repetition, as there is no doubt that the mere process of beating must have required, even if it could have been performed without danger. The various modes which are employed in India, and the adjacent islands, for keeping up the supply of elephants for domestic use, are much more complicated than the Roman naturalist appears to have thought necessary; and these modes are followed up by a steady application of mild coercion, which at length effectually converts the unwieldy force of the huge quadruped into a machine, nearly as precise and obedient as one of those many ingenious inventions of modern times which have so greatly dispensed with the irregular movements of animal power.

The rudest mode of taking the elephant is by digging a pit in his native forests, which is covered over with loose boards and the boughs and grass upon which he feeds. This is mentioned as the custom of Ceylon a century ago;—and the Sieur Brue describes this as the mode of taking the elephant, for his flesh, by the Africans of Senegal. Mr Williamson states that in places where the natives find the elephants destructive neighbours, they dig a pit, covered with a slight platform of branches and grass, towards which the herd is seduced by a tame

The elephant, when once tamed, becomes the most gentle and obedient of all animals. It soon conceives an attachment for the person that attends it, caresses him, obeys him, and seems to anticipate his desires. In a short time it begins to comprehend several of the signs made to it, and even the different sounds of the voice; it perfectly distinguishes the

---

elephant, when the leading pursuer is precipitated into the trap, and the remainder retire in great alarm. This practice is evidently not very successful; and we apprehend that the instinctive caution of the elephant not to tread upon any insecure ground must render it unavailing, except when his natural prudence gives way to the more powerful impulses of terror or desire. "The mode of getting elephants out of pits," according to Mr Williamson, "is somewhat curious, but extremely simple. The animal is for the most part retained until sufficiently tractable to be conducted forth; when large bundles of jungle-grass tied up into sheaves being thrown to him, he is gradually brought to the surface, at least to such an elevation as may enable him to step out." The elephant will do the same if he is swamped in boggy ground, thrusting the bundles of grass and straw into the yielding earth with his heavy feet, and placing them so around him with his trunk that he at last obtains a firm footing. Pliny, who mentions the manner of taking elephants in pits, says, that the companions of the unfortunate animal who is thus captured will throw branches and masses of earth into the hole to assist his deliverance. This appears somewhat incredible;—but we are enabled to confirm, by an anecdote which has been published by Mr Pringle, the disposition of these animals to assist a suffering companion:—

"In the year 1821, during one of my excursions in the interior of the Cape Colony, I happened to spend a few days at the Moravian missionary settlement of Enon, or White River. This place is situated in a wild but beautiful valley, near the foot of the Zuurberg mountains, in the district of Uitenhage, and is surrounded on every side by extensive forests of evergreens, in which numerous herds of elephants still find food and shelter. From having been frequently hunted by the Boors and Hottentots, these animals are become so shy as scarcely ever to be seen during the day except among the most remote and inaccessible ravines and jungles; but in the night they frequently issue forth in large troops, and range in search of food, through the inhabited farms in the White River Valley; and on such occasions they sometimes revenge the wrongs of their race upon the settlers who have taken possession of their ancient haunts, by pulling up fruit trees, treading down gardens and corn-fields, breaking their ploughs, waggons, and so forth. I do not mean, however, to affirm that the elephants really do all this mischief from feelings of revenge, or with the direct intention of annoying their human persecutors. They pull up the trees, probably, because they want to browse on their soft roots, and they demolish the agricultural implements merely because they happen to be in their way. But what I am now about to state assuredly indicates no ordinary intelligence. A few days before my arrival at Enon, a troop of elephants came down one dark and rainy night, close to the outskirts of the village. The missionaries heard them bellowing and making an extraordinary noise for a long time at the upper end of their orchard; but knowing well how dangerous it is to encounter these powerful animals in the night, they kept close within their houses till day-light. Next morning, on their examining the spot where they had heard the elephants, they discovered the cause of all this nocturnal uproar. There was at this spot a ditch or trench, about four or five feet in width, and nearly fourteen feet in depth, which the industrious missionaries had recently cut through the bank of the river, on purpose to lead out the water to irrigate some part of their garden ground, and to drive a corn mill. Into this trench, which was still unfinished and without water, one of the elephants had evidently fallen, for the marks of his feet were distinctly visible at the bottom, as well as the impress of his huge body on its sides. How he had got into it was easy to conjecture; but how, being once in, he had ever contrived to get out again, was the marvel. By his own unaided efforts it was obviously impossible for such an animal to have extricated himself. Could his comrades, then, have assisted him? There can be no question that they had—though by what means, unless by hauling him out with their trunks, it would not be easy to conjecture. And in corroboration of this supposition, on examining the spot myself, I found the edges of this trench deeply indented with numerous vestiges, as if the other elephants had stationed themselves on either side, some of them kneeling and others on their feet, and had thus by united efforts, and probably after many failures, hoisted their unlucky brother out of the pit."

However unfrequent may be such instances of intelligent compassion amongst elephants, it is undoubted that the sagacity of the animal enables him to perceive that he may escape from the perilous confinement of a deep pit, if he is supplied with the means of raising his enormous body nearly to the surface of the ground. A very curious anecdote, which not only illustrates this instinctive knowledge, but exemplifies the general exercise of the mental power of the "half-reasoning" animal, is given in Cuvier's Animal Kingdom, by Griffith.

"At the siege of Bhurtpore in the year 1805, an affair occurred between two elephants, which displays at once the character and mental capability, the passions, cunning, and resources of these curious animals. The British army, with its countless host of followers and attendants, and thousands of cattle, had been for a long time before the city, when on the approaching of the hot season, and of the dry hot winds, the supply of water in the neighbourhood of the camps necessary for the supply of so many beings, began to fail; the ponds or tanks had dried up and no more water was left than the immense wells of the country would furnish. The multitude of men and cattle that were unceasingly at the wells, particularly the largest, occasioned no little struggle for the priority in procuring the supply for which each were there to seek, and the consequent confusion on the spot was frequently very considerable. On one occasion, two elephant drivers, each with his elephant, the one remarkably large and strong, and the other comparatively small and weak, were at the well together; the small elephant had been provided by his master with a bucket for the occasion, which he carried at the end of his proboscis; but the larger animal being destitute of this necessary vessel, either spontaneously or by desire of his keeper, seized the bucket, and easily wrested it away from his less powerful fellow-servant; the latter was too sensible of his inferiority, openly to resent the insult, though it is obvious that he felt it; but great squabbling and abuse ensued between the keepers. At length, the weaker animal, watching the opportunity when the other was standing with his side to the well, retired backwards a few paces in a very quiet, unsuspicious manner, and then rushing forward with all his might, drove his head against the side of the other, and fairly pushed him into the well.

"It may easily be imagined that great inconvenience was immediately experienced, and serious apprehensions quickly followed, that the water in the well, on which the existence of so many seemed in a great measure to depend, would be spoiled, or at least injured by the unwieldy brute which was precipitated into it; and tone of command from that of anger or approbation, and acts accordingly. It is seldom deceived in its master's voice ; it receives his orders, with attention, and executes them with prudence, eagerly, yet without precipitation. All its motions are regulated, and its actions seem to partake of its magnitude ; being grave, majestic, and secure. It is quickly

---

as the surface of the water was nearly twenty feet below the common level, there did not appear to be any means that could be adopted to get the animal out by main force, at least without injuring him : there were many feet of water below the elephant, who floated with ease on its surface, and experiencing considerable pleasure from his cool retreat, evinced but little inclination even to exert what means he might possess in himself of escape.

" A vast number of fascines had been employed by the army in conducting the siege, and at length it occurred to the elephant keeper, that a sufficient number of these (which may be compared to bundles of wood) might be lowered into the well to make a pile, which might be raised to the top, if the animal could be instructed as to the necessary means of laying them in regular succession under his feet. Permission having been obtained from the engineer officers to use the fascines, which were at the time put away in several piles of very considerable height, the keeper had to teach the elephant the lesson, which by means of that extraordinary ascendency these men attain over the elephants, joined with the intellectual resources of the animal itself, he was soon enabled to do, and the elephant began quickly to place each fascine as it was lowered to him, successively under him, until in a little time he was enabled to stand upon them ; by this time, however, the cunning brute, enjoying the pleasure of his situation, after the heat and partial privation of water to which he had been lately exposed, (they are observed in their natural state to frequent rivers, and to swim very often,) was unwilling to work any longer, and all the threats of his keeper could not induce him to place another fascine. The man then opposed cunning to cunning, and began to caress and praise the elephant, and what he could not effect by threats he was enabled to do by the repeated promise of plenty of rack. Incited by this the animal again went to work, raised himself considerably higher, until, by a partial removal of the masonry round the top of the well, he was enabled to step out ; the whole affair occupied about fourteen hours."

In Nepaul, and in the countries bordering on the northern frontiers of India, where the elephants are of a small size, they are often captured by the natives with a *phaun*, or slip-knot. This practice has some analogy with the custom of taking horses with the *lasso*, in the Pampas. The hunter, seated on a docile elephant, round whose body the cord is fastened, singles out one from the wild herd ; and cautiously approaching, throws his pliable rope in such a manner that it rests behind the ears, and over the brow of the animal pursued. He instinctively curls up his trunk, making an effort to remove the rope ; which, with great adroitness on the part of the hunter, is then passed forward over the neck. Another hunter next comes up, who repeats the process; and thus the creature is held by the two tame elephants, to whom the *phauns* are attached, till his strength is exhausted. It would appear quite impossible to take a large elephant in this manner ; although, with those of a peculiar small breed, the operation does not appear more difficult than that of securing the wild horse or the buffalo in the plains of South America.

It is remarkable, that in every mode of capturing the wild elephant, man avails himself of the docility of individuals of the same species, which he has already subdued. Birds may be taught to assist in ensnaring other birds ; but this is simply an effect of habit. The elephant, on the contrary, has an evident desire to join its master in subduing its own race: and in this treachery to its kind, exercises so much ingenuity, courage, and perseverance, that we cannot find a parallel instance of complete subjection to the will of him to whom it was given to " have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth."

From some peculiar circumstances which have not been accurately explained, large male elephants are sometimes found apart from the herd. Sir Stamford Raffles says, speaking of the elephants that he met with in his journey through the southern presidencies to Passumah, " The natives fancy that there are two kinds of elephants,—the gaja *berkampong*, those which always go in herds, and which are seldom mischievous, and the gaja *satunggal*, or single elephants, which are much larger and ferocious, going about either singly or only two or three in company. It is probable the latter kind are only the full-grown males." They probably, in many cases, separate themselves from their companions in search of fresh pastures. But as they are sometimes found in a state of considerable irritation, doing much mischief wherever they pass, it has been thought that these have been driven away by the stronger males, and that they are suffering all the agonies of unavailing jealousy. Being the finest elephants, and therefore the best adapted for sale, the hunters soon mark them for their own. They follow them cautiously by day and by night, with two and sometimes four trained females, called *Koomkies*. If it be dark they can hear the animal striking his foot, to clean it, against his fore legs, and they then approach tolerably close ;—if light, they advance more cautiously. The females gradually move towards him, apparently unconscious of his presence, grazing with great complacency, as if they were, like him, inhabitants of the wild forest. It is soon perceived by them whether he is likely to be entrapped by their arts. The drivers remain concealed at a little distance, while the *koomkies* press round the unhappy *goondah*, or *saun*, for so this sort of elephant is called. If he abandon himself to the caresses of his new companions, his capture is almost certain. The hunters cautiously creep under him, and during the intoxication of his pleasure, fasten his fore-legs with a strong rope. It is said that the wily females will not only divert his attention from their *mahouts*, but absolutely assist them in fastening the cords. Mr Howitt made a spirited drawing of this curious scene. from the descriptions of Captain Williamson.

The hind-legs of the captive being secured in a similar manner, the hunters leave him to himself, and retire to a short distance. In some cases he is fastened at once to a large tree, if the situation in which he is first entrapped allows this. But under other circumstances, in the first instance his legs are only tied together. When the females quit him he discovers his ignominious condition, and attempts to retreat to the covert of the forest. But he moves with difficulty, in consequence of the ropes which have been lashed round his limbs. There are long cables trailing behind him ; and the mahouts, watching an opportunity, secure these to a tree of sufficient strength. He now becomes furious, throwing himself down, and thrusting his tusks into the earth. If he break the cables, and escape into the forest, the hunters dare not pursue him ; but if he is adequately bound, he soon becomes exhausted with his own rage. He is then left to the further operation of hunger, till he is sufficiently subdued to be conducted, under the escort of his treacherous friends, to an appointed station, to which, after a few months' discipline, he becomes reconciled.

taught to kneel down, to receive its rider; it caresses those it knows with its trunk; with this salutes such as it is ordered to distinguish, and with this, as with a hand, helps to take up a part of its load. It suffers itself to be arrayed in harness, and seems to take a pleasure in the finery of its trappings. It draws either chariots, cannon, or shipping, with surprising strength and perseverance; and this with a seeming satisfaction, provided that it be not beaten without a cause, and that its master appears pleased with its exertions.

The elephant's conductor is usually mounted upon its neck, and makes use of a rod of iron to guide it, which is sometimes pointed, and at others bent into a hook. With this the animal is spurred forward when dull or disobedient; but, in general, a word is sufficient to put the gentle creature into motion, especially when it is acquainted with its conductor. This acquaintance is often perfectly necessary; for the elephant frequently takes such an affection to its keeper, that it will obey no other; and it has been known to die for grief, when, in some sudden fit of madness, it has killed its conductor. We are told, that one of these, that was used by the French forces in India for the drawing their cannon, was promised, by the conductor, a reward, for having performed some painful service; but being disappointed of its expectations, it slew him in a fury. The conductor's wife, who was a spectator of this shocking scene, could not restrain her madness and despair; but running with her two children in her arms, threw them at the elephant's feet, crying out, that since it had killed her husband it might kill her and her children also. The elephant, seeing the children at its feet, instantly stopped, and moderating its fury, took up the eldest with its trunk, and placing him upon its neck, adopted him for its conductor, and obeyed him ever after with great punctuality.

But it is not for drawing burdens alone, that the elephants are serviceable in war; they are often brought into the ranks, and compelled to fight in the most dangerous parts of the field of battle. There was a time, indeed, in India, when they were much more used in war than at present. A century or two ago, a great part of the dependence of the general was upon the number and the expertness of his elephants; but of late, since war has been contented to adopt fatal instead of formidable arts, the elephant is little used, except for drawing cannon, or transporting provisions. The princes of the country are pleased to keep a few for ornament, or for the purposes of removing their seraglios; but they are seldom led into a field of battle, where they are unable to withstand the discharge of fire-arms, and have often been found to turn upon their employers. Still, however, they are used in war, in the more remote parts of the East; in Siam, in Cochin-China, in Tonquin, and Pegu. In all these places they not only serve to swell the pomp of state, being adorned with all the barbarian splendour that those countries can bestow, but they are actually led into the field of battle, armed before with coats of mail, and loaded on the back each with a square tower, containing from five to seven combatants. Upon its neck sits the conductor, who goads the animal into the thickest ranks, and encourages it to increase the devastation: wherever it goes, nothing can withstand its fury; it levels the ranks with its immense bulk, flings such as oppose it into the air, or crushes them to death under its feet. In the meantime those who are placed upon its back, combat as from an eminence, and fling down their weapons with double force, their weight being added to their velocity. Nothing, therefore, can be more dreadful, or more irresistible, than such a moving machine, to men unacquainted with the modern arts of war; the elephant thus armed and conducted, raging in the midst of the field of battle, inspires more terror than even those machines that destroy at a distance, and are often most fatal when most unseen. But this method of combating is rather formidable than effectual: polished nations have ever been victorious over those semibarbarous troops that have called in the elephant to their assistance or attempted to gain a victory by merely astonishing their opposers. The Romans quickly learned the art of opening their ranks to admit the elephant, and thus separating it from assistance, quickly compelled its conductors to calm the animal's fury, and to submit. It sometimes also happened that the elephant became impatient of control; and, instead of obeying its conductor, turned upon those forces it was employed to assist. In either case, there was a great deal of preparation to very little effect, for a single elephant is known to consume as much as forty men in a day.

At present, therefore, they are chiefly employed in carrying, or drawing burdens, throughout the whole peninsula of India; and no animal can be more fitted by nature for this employment. The strength of an elephant is equal to its bulk, for it can, with great ease, draw a load that six horses could not move; it can readily carry upon its back three or four thousand weight; upon its tusks alone it can support near a thousand: its

---

In the kingdom of Ava all the elephants are caught by decoy females, though the process is somewhat different from that practised by the Koomkies of British India.

force may also be estimated from the velocity of its motion, compared to the mass of its body. It can go, in its ordinary pace, as fast as a horse at an easy trot; and, when pushed, it can move as swiftly as a horse at full gallop. It can travel with ease fifty or sixty miles a-day; and, when hard pressed, almost double that distance. It may be heard trotting on at a great distance; it is easy also to follow it by the track, which is deeply impressed on the ground, and from fifteen to eighteen inches in diameter.

In India they are also put to other very disagreeable offices;[1] for in some courts of the more barbarous princes they are used as executioners: and this horrid task they perform with great dexterity: with their trunks they are seen to break every limb of the criminal at the word of command; they sometimes trample him to death, and sometimes impale him on their enormous tusks, as directed. In this the elephant is rather the servant of a cruel master than a voluntary tyrant, since no other animal of the forest is so naturally benevolent and gentle; equally mindful of benefits as sensible of neglect, he contracts a friendship for his keeper, and obeys him even beyond his capacity.

In India, where they were at one time employed in launching ships, a particular elephant was directed to force a very large vessel into the water: the work proved superior to its strength, but not to its endeavours; which, however, the keeper affected to despise. "Take away," says he, "that lazy beast, and bring another better fitted for service." The poor animal instantly upon this redoubled its efforts, fractured its skull, and died upon the spot.

In Delhi, an elephant passing along the streets put his trunk into a tailor's shop, where several people were at work. One of the persons of the shop, desirous of some amusement, pricked the animal's trunk with his needle, and seemed highly delighted with this slight punishment. The elephant, however, passed on without any immediate signs of resentment; but coming to a puddle filled with dirty water, he filled his trunk, returned to the shop, and spurted the contents over all the finery upon which the tailors were then employed.

An elephant in Adsmeer, which often passed through the bazar or market, as he went by a certain herb-woman, always received from her a mouthful of greens. Being one day seized with a periodical fit of madness he broke his fetters, and running through the market, put the crowd to flight, and among others, this woman, who, in her haste forgot a little child at her stall. The elephant recollecting the spot where its benefactress was accustomed to sit, took up the infant gently in its trunk, and conveyed it to a place of safety.

At the Cape of Good Hope it is customary to hunt those animals for the sake of their teeth.[2] Three horsemen, well mounted, and armed with lances, attack the elephant alternately, each relieving the other, as they see their companion pressed, till the beast is subdued. Three Dutchmen, brothers, who had made large fortunes by this business, determined to retire to Europe, and enjoy the fruits of their labours; but they resolved, one day before they went, to have a last chase, by way of amusement: they met with their game, and began their attack in the usual manner; but, unfortunately, one of their horses falling, happened to fling his rider; the enraged elephant instantly seized the unhappy huntsman with his trunk, flung him up to a vast height in the air, and received him upon one of the tusks as he fell: and then turning towards the other two brothers, as if it were with an aspect of revenge and insult, held out to them the impaled wretch, writhing in the agonies of death.

---

[1] The elephant is often made a sufferer from the propensity of man to cruel sports. In India, elephants are to this day baited; and the native chiefs and nobles at tach great importance to these displays. When Bishop Heber was at the court of Baroda, "The Raja," he says, "was anxious to know whether I had observed his rhinoceros and his hunting tigers, and offered to show me a day's sport with the last, or to bait an elephant for me; a cruel amusement which is here not uncommon —I do not think he understood my motive for declining to be present. A Mussulman, however, who sat near him, seemed pleased by my refusal, said it was 'very good,' and asked me if any of the English clergy attended such sports. I said it was a maxim with most of us to do no harm to any creature needlessly: which was, he said, the doctrine of their learned men also." At the palace of Jyepoor, says the same humane person, "we were shown five or six elephants in training for a fight. Each was separately kept in a small paved court, with a little litter but very dirty. They were all, what is called 'must,' that is, fed on stimulating substances to make them furious; and all showed in their eyes, their gaping mouths, and the constant motion of their trunks, signs of fever and restlessness. Their mahouts seemed to approach them with great caution; and on hearing a step they turned round as far as their chains would allow, and lashed fiercely with their trunks. I was moved and disgusted at the sight of so noble creatures, thus maddened and diseased by the absurd cruelty of man, in order that they might for his diversion inflict fresh pain and injuries on each other."

[2] The imports of elephants' teeth, in 1831 and 1832, were, at an average, 4,130 cwt., of which 2,950 cwt. were retained for consumption. The medium weight of a tusk may be taken at about 60 lbs.; so that the yearly imports of 1831 and 1832 may be taken at 7,709 tusks; a fact which supposes the destruction of at least 3,854 male elephants! But, supposing the tusks could only be obtained by killing the animal, the destruction would really be a good deal greater, and would most probably, indeed, amount to 4,500 or 5,000 elephants. Occasionally, however, tusks are accidentally broken, one lost in this way being replaced by a new one; and a good many are, also, obtained from elephants that have died in the natural way. Still it is sufficiently obvious, that the supply from the sources now alluded to cannot be very large; and if to the quantity of ivory required for Great Britain, we add that required for the other countries of Europe, America, and Asia, the slaughter of elephants must, after every reasonable deduction is made, appear immense; and it may well excite surprise, that the breed of this noble animal has not been more diminished. The western and eastern coasts of Africa, the Cape of Good Hope, Ceylon, India, and the countries to the eastward of the Straits of Malacca, are the great marts whence supplies of ivory are derived. The imports from Western Africa into Great Britain, in 1831, amounted to 2,575 cwt.; the Cape only furnished 198 cwt. The imports during the same year from India, Ceylon, &c. were 2,573 cwt.—*Parl. Paper*. No. 550. Sess. 1833.) The Chinese market is principally supplied with ivory from Malacca, Siam, and Sumatra.

The teeth of the elephant are what produce the great enmity between him and mankind; but whether they are shed like the horns of the deer, or whether the animal be killed to obtain them, is not yet perfectly known. All we have as yet certain is, that the natives of Africa, from whence almost all our ivory comes, assure us that they find the greatest part of it in their forests; nor would, say they, the teeth of an elephant recompense them for their trouble and danger in killing it: notwithstanding, the elephants which are tamed by man are never known to shed their tusks; and from the hardness of their substance, they seem no way analogous to deer's horns.

The teeth of the elephant are very often found in a fossil state. Some years ago, two great grinding-teeth, and part of the tusk of an elephant, were discovered at the depth of forty-two yards in a lead-mine in Flintshire.[1]

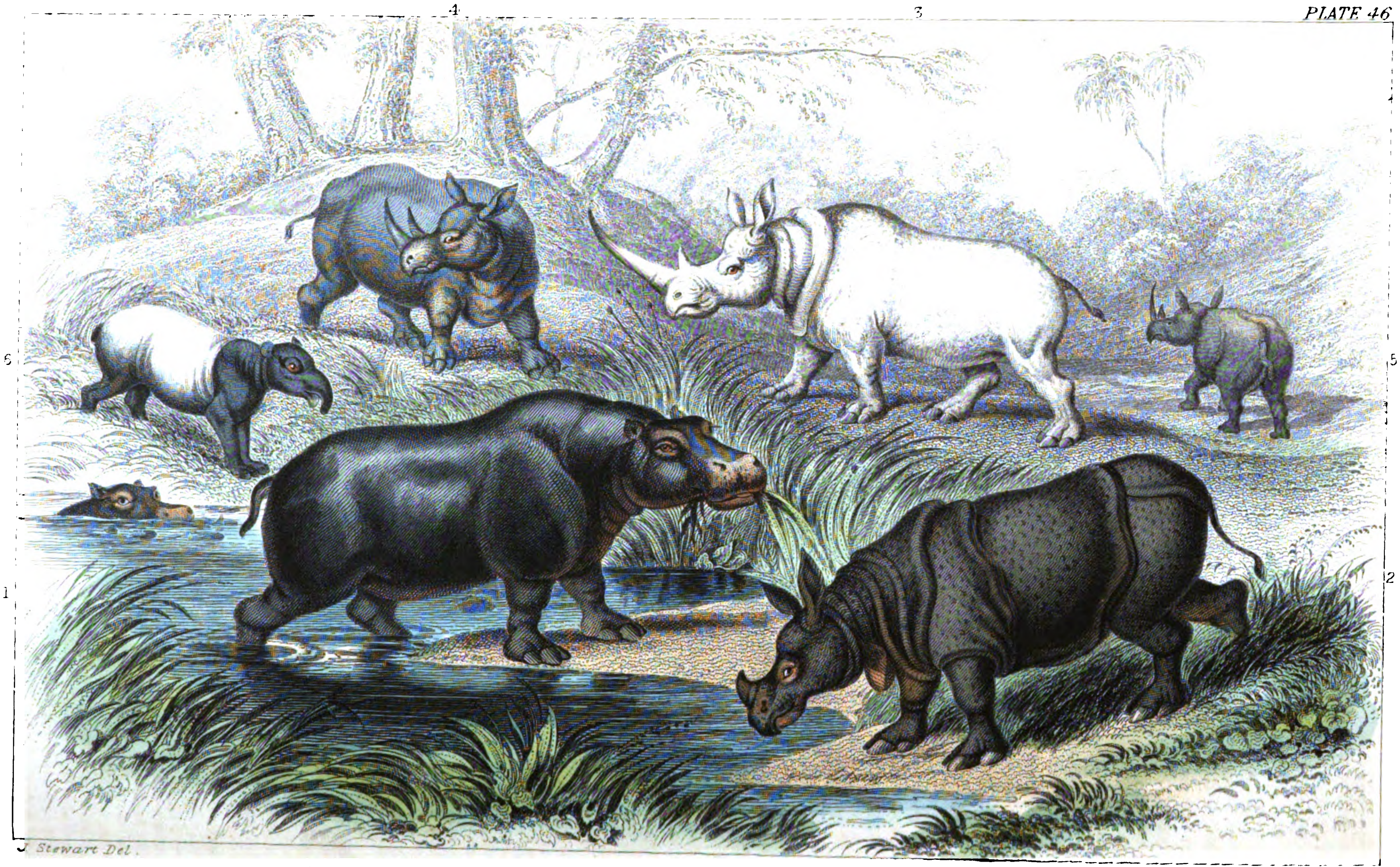
The tusks of the mammoth, so often found fossil in Siberia, and which are converted to the purposes of ivory, are generally supposed to belong to the elephant: however, the animal must have been much larger in that country than it is found at present, as those tusks are often known to weigh four hundred pounds; while those that come from Africa seldom exceed two hundred and fifty. These enormous tusks are found lodged in the sandy banks of the Siberian rivers; and the natives pretend that they belong to an animal which is four times as large as the elephant. (For a view of the bones of the mammoth, see Plate XI. fig. 42.)

There have lately been discovered several enormous skeletons, five or six feet beneath the surface, on the banks of the Ohio, not remote from the river Miume, in America, seven hundred miles from the sea-coast. Some of the tusks are near seven feet long; one foot nine inches in circumference at the base, and one foot near the point; the cavity at the root or base nineteen inches deep. Besides their size, there are yet other differences: the tusks of the true elephant have sometimes a very slight lateral bend; these have a larger twist, or spiral curve, towards the smaller end: but the great and specific difference consists in the shape of the grinding teeth; which, in these newly found, are fashioned like the teeth of a carnivorous animal; not flat and ribbed transversely on their surface, like those of the modern elephant, but furnished with a double row of high and conic processes, as if intended to masticate, not to grind their food. A third difference is in the thigh-bone, which is of a great disproportionable thickness to that of the elephant; and has also some other anatomical variations. These fossil bones have been also found in Peru and the Brazils; and when cut and polished by the workers in ivory, appear, in every respect, similar. It is the opinion of Dr Hunter that they must have belonged to a larger animal than the elephant; and differing from it in being carnivorous. But as yet this formidable creature has evaded our search; and if, indeed, such an animal exists, it is happy for man that it keeps at a distance; since what ravage might not be expected from a creature endued with more than the strength of the elephant, and all the rapacity of a tiger![2]

The chief consumption of ivory in England is in the manufacture of handles for knives; but it is also extensively used in the manufacture of musical and mathematical instruments, chess-men, billiard-balls, plates for miniatures, toys, &c. Ivory articles are said to be manufactured to a greater extent, and with better success, at Dieppe, than in any other place in Europe. But the preparation of this beautiful material is much better understood by the Chinese than by any other people. No European artist has hitherto succeeded in cutting concentric balls after the manner of the Chinese: and their boxes, chess-men, and other ivory articles, are all far superior to any that are to be met with any where else.—*Macculloch's Commercial Dictionary.*

[1] Pennant's Synopsis, p. 90.

[2] Fossil elephants have been found in almost every part of the known world, in Europe, Asia, Africa, and not less in America; in the valleys formed by rivers, and on the high neighbourhood of the Andes, of which the specimens sent to Paris by Humboldt, from Villa d'Ibarra, are examples; in the scorching regions of the torrid zone, and on the icy shores of the frozen ocean. England, France, and Germany, possess amongst other countries their share of these relics of a former world, as the fossil bones of Kirkdale, Bondi, and the Hartz, amply testify. They are commonly found in the moveable and superficial beds of the earth, and particularly in those alluvial deposits which fill up the bottom of valleys, or which border the courses of rivers; they are rarely covered by rocks, and are most frequently accompanied by other fossil bones of known genera of quadrupeds, and often by marine or fresh water shells. With but very few exceptions they are found in unconnected heaps; but in those situations in which whole skeletons are found, they appear as it were buried in a kind of clay, and in some instances even the skin and flesh are preserved, as in that described by Gabriel Sarvtschew, in



J. Stewart Del.

J. Fisher Sc.

1 HIPPOPOTAMUS. 2 INDIAN RHINOCEROS. 3 MUCHOCO WHITE RHINOCEROS.
4 5 TWO HORNED AFRICAN RHINOCEROS. 6 MALAY TAPIR

CHAP. III.

OF THE RHINOCEROS.

(*See Plate XIV. fig.* 5.)

Next to the elephant, the rhinoceros is the most powerful of animals. It is usually found twelve feet long from the tip of the nose to the insertion of the tail; from six to seven feet high; and the circumference of its body is nearly equal to its length. It is, therefore, equal to the elephant in bulk: and if it appears much smaller to the eye, the reason is, that its legs are much shorter. Words can convey but a very confused idea of this animal's shape; and yet there are few so remarkably formed: its head is furnished with a horn, growing from the snout, sometimes three feet and a half long; and but for this, that part would have the appearance of the head of a hog; the upper lip, however, is much longer in proportion, ends in a point, is very pliable, serves to collect its food, and deliver it into the mouth: the ears are large, erect, and pointed; the eyes are small and piercing; the skin is naked, rough, knotty, and lying upon the body in folds, after a very peculiar fashion: there are two folds very remarkable; one above the shoulders, and another over the rump: the skin, which is of a dirty brown colour, is so thick as to turn the edge of a scimitar, and to resist a musket-ball; the belly hangs low; the legs are short, strong, and thick, and the hoofs divided into three parts, each pointing forward.

Such is the general outline of an animal that appears chiefly formidable from the horn growing from its snout; and formed rather

---

his voyage along the north-eastern coast of Siberia, and that of Mr Adams, discovered near the mouth of the Lena.

The great depository of elephants' bones, however, appears to be Asiatic Russia, and indeed, so numerous are they that the natives carry on a very extensive trade in the fossil ivory found there, and known by the name of *Mammontovakost*, or mammoth's teeth, which they suppose belong to an animal which they have named the mammoth, believing it lives like the mole, burrowing under the earth, but dies as soon as it sees daylight. This curious notion they seem to have held in common with the Chinese; for a writer of theirs on natural history of the sixteenth century, named Bun-zoo-gann-mu, has given a detail of the habits of an animal which he calls *Tienschu*, very closely resembling those ascribed to the mammoth.

The mammoth described by Mr Adams, in the fifth volume of the *Memoirs of the Academy of St Petersburg*, was first discovered by a Tongouse fisherman in the year 1799, on the banks of the Icy sea, near the mouth of the Lena, in a large misshapen block of ice. In the following year this became separated from the surrounding masses but in the subsequent summer, the ice having melted away one whole side, one tusk of the animal was distinctly visible. The gradual development of this remarkable creature continued from year to year till the fifth after its discovery, when, in consequence of the ice having broken up early, it was drifted ashore, and the fisherman, in the month of March, 1804, despoiled it of its tusks, which he sold for fifty rubles. Two years after this, Mr Adams, who was travelling with Count Golovkin's embassy to China, hearing of this at Iakutsck, made a journey to the spot for the purpose of seeing it. He found the skeleton perfect, with the exception of one foot, but the flesh had been given by the natives of Iakutsck to their dogs, and the wild beasts in the neighbourhood had also assisted in consuming what had been left. The greater part of the skeleton was found connected by its natural ligaments, and those bones which were separated were collected in the neighbourhood. The head was covered with a dry skin, the ball of one eye was remaining, and one ear furnished with a tuft of hair. The brain was found dried up in the skull; the neck ornamented with a long mane; the skin covered with black hairs, and a reddish kind of fur or wool; and the weight of the skin which remained so great as to require the hard labour of ten men to remove it; besides which, at least thirty pounds of hair were collected from the ground. The animal was a male, and its tusks were nine feet in length. It was purchased by the emperor of Russia for 8000 roubles, and placed by him in the academy of St Petersburg.

The islands north of Siberia, opposite the coast separating the mouth of the Lena from that of the Indigirska, are so remarkable for the immense quantity of these fossil bones, that the editor of Billing's Voyage states, "every island is formed of the bones of this extraordinary animal, of the horns and skulls of buffaloes, or animals nearly resembling them, and of some rhinoceros' horns." "*Description*," says Cuvier, "*tres exagerée sans doute, mais qui prouve a quel point ces os y sont abondans.*"

In America fossil elephant bones are found, particularly in the state of Kentucky, along the banks of the Ghi, and the most remarkable assemblage are found at Big Bone Lick, which was closely examined by governor Clarke, and whence numerous specimens were sent by him to Washington. Humboldt also discovered part of a fossil tusk at Villa de Ibarra, in the province of Quito in Peru, a hundred and seventeen toises above the level of the sea.

In a pamphlet published in 1831, at Sydney, New South Wales, by the Rev. J. D. Lang, detailing the steps which had been taken for the establishment of an academical institution, or college, in that colony, we find the following curious statement:—"A collection of fossil bones which had been discovered in a lime-stone cave at Wellington Valley, by George Rankin, Esq., of Bathurst, and to the discovery of which the writer had the honour of calling the attention of the colonial public, in an anonymous letter published in the *Sydney Gazette*, about eighteen months ago, was entrusted to the writer by Mr Rankin, for Professor Jameson, of the university of Edinburgh. One of the bones had evidently belonged to some large animal; and Professor Jameson and an eminent naturalist of the college of surgeons in London, to whom it had afterwards been forwarded, coincided in regarding it as a bone of the hippopotamus. Not satisfied, however, with their own opinion concerning it, it was subsequently sent to M. Le Baron Cuvier of Paris; and that distinguished naturalist (Professor Jameson informed the writer just before leaving Scotland) had ascertained that it was the thigh-bone of a young elephant; thereby establishing the interesting and important fact, that the wilds of Australia were once traversed by that enormous quadruped."

for war than with a propensity to engage.[1] This horn is sometimes found from three to three feet and a half long, growing from the solid bone, and so disposed as to be managed to the greatest advantage. It is composed of the most solid substance; and pointed so as to inflict the most fatal wounds. The elephant, the boar, or the buffalo, are obliged to strike transversely with their weapons; but the rhinoceros employs all his force with every blow; so that the tiger will more willingly attack any other animal of the forest, than one whose strength is so justly employed. Indeed, there is no force which this terrible animal has to apprehend: defended on every side, by a thick horny hide, which the claws of the lion or the tiger are unable to pierce, and armed before with a weapon that even the elephant does not choose to oppose. The missionaries assure us, that the elephant is often found dead in the forests, pierced with the horn of a rhinoceros; and though it looks like wisdom to doubt whatever they tell us, yet I cannot help giving credit to what they relate on this occasion, particularly when confirmed by Pliny. The combat between these two, the most formidable animals of the forest, must be very dreadful. Emanuel, king of Portugal willing to try their strength, actually opposed them to each other; and the elephant was defeated.

But though the rhinoceros is thus formidable by nature, yet imagination has not failed to exert itself, in adding to its terrors. The scent is said to be most exquisite; and it is affirmed that it consorts with the tiger. It is reported also, that when it has overturned a man, or any other animal, it continues to lick the flesh quite from the bone with its tongue, which is said to be extremely rough. All this, however, is fabulous: the scent, if we may judge from the expansion of the olfactory nerves, is not greater than that of a hog, which we know to be indifferent; it keeps company with the tiger, only because they both frequent watery places in the burning climates where they are bred; and as to its rough tongue, that is so far from the truth, that no animal of near its size has so soft a one. "I have often felt it myself," says Ladvocat, in his description of this animal; "it is smooth, soft, and small, like that of a dog; and to the feel it appears as if one passed the hand over velvet; I have often seen it lick a young man's face who kept it, and both seemed pleased with the action.

The rhinoceros which was shown at London in 1739, and described by Dr Parsons, had been sent from Bengal. Though it was very young, not being above two years old, yet the charge of its carriage and food from India cost near a thousand pounds. It was fed with rice, sugar, and hay: it was daily supplied with seven pounds of rice, mixed with three of sugar, divided into three portions; it was given great quantities of hay and grass, which it chiefly preferred; its drink was water, which it took in great quantities. It was of a gentle disposition, and permitted itself to be touched and handled by all visitors, never attempting mischief, except when abused, or when hungry; in such a case there was no method of appeasing its fury but by giving it something to eat. When angry, it would jump up against the walls of its room with great violence, and made many efforts to escape, but seldom attempted to attack its keeper, and was always submissive to his threats. It had a peculiar cry, somewhat a mixture between the grunting of a hog and the bellowing of a calf.

---

[1] The horn of the rhinoceros is formed much like a limpet-shell, but more pointed;—at its base it is generally about six inches long by four inches wide, and it protrudes about six or eight inches. There is a shallow concavity occupying the whole base, resembling the limpet also in this respect. To judge of the goodness of a rhinoceros' horn, this concave part is put to the ear, and the greater the noise, resembling that of the waves on the sea-beach, the better the horn is judged to be by the Chinese. Some naturalists describe the horn as solid, fixed, and attached to the bone of the nose; but it is certainly connected with the skin only, and is capable of motion. The structure of the horn seems to confirm the opinion that the horns of animals are merely the result of a particular modification of hair: it is so fibrous that it seems to be no more than an agglutination of hairs. Its use appears to be that of a defensive weapon, as well as for the purpose of uprooting or rending the animal's food. In a state of confinement, it has been observed that he strikes with it in his moments of fury, and employs it to rend and destroy that which has yielded to his efforts; it is also brought more into use than any other part in all cases where the employment of force is necessary. It is particularly adapted by its form to be made into cups, and is much applied to that use. Thunberg says, "It is generally believed that goblets made of the horns in a turner's lathe, will discover any poisonous draught that is put into them by making the liquor ferment until it runs quite out of the goblet. Such goblets are frequently set in gold and silver, and are regarded as suitable presents to kings, persons of distinction, or particular friends; or else they are sold at a high price, sometimes at the rate of fifty rix-dollars a goblet. When I tried these horns, both wrought and unwrought,—both old and young horns,—with several sorts of poison,—weak as well as strong,—I observed not the least motion or effervescence; and when a solution of corrosive sublimate, or other similar substance, was poured into one of these horns, there arose only a few bubbles, produced by the air which had been enclosed in the pores of the horn, and which was now disengaged from it."

Besides the use of its horns for goblets and handles of swords and daggers, there is scarcely any part of the animal which is not employed medicinally in the countries it inhabits. The hide is much in request for shields in most countries where it can be procured; and an extravagant price is sometimes paid for it. Burckhardt sometimes saw as much as four or five Spanish dollars paid for a piece four inches long and one thick.

The rhinoceros lives in shady forests adjoining rivers, or in the swampy jungles with which its native country abounds. It is fond of wallowing in the mud like the hog; it also grunts like that animal, and its flesh is said to have much resemblance to pork, though of a coarser grain and stronger taste. Its chief food appears to consist of roots, small branches of trees, and succulent plants, some of which are harsh and prickly. The rhinoceros is a solitary animal; and the female produces one at a birth. The growth of the young is very gradual, as at the age of two years it scarcely attains half its height.

The age of these animals is not well known; it is said by some, that they bring forth at three years old; and if we may reason from analogy, it is probable they seldom live till above twenty. That which was shown in London was said by its keeper to be eighteen years old, and even at that age he pretended to consider it as a young one; however, it died shortly after, and that probably in the course of nature.

The rhinoceros is a native of the deserts of Asia and Africa, and is usually found in those extensive forests that are frequented by the elephant and the lion. As it subsists entirely upon vegetable food, it is peaceful and harmless among its fellows of the brute creation; but, though it never provokes to combat, it equally disdains to fly. It is every way fitted for war, but rests content in the consciousness of its security. It is particularly fond of the prickly branches of trees, and is seen to feed upon such thorny shrubs as would be dangerous to other animals, either to gather or to swallow. The prickly points of these, however, may only serve to give a poignant relish to this animal's palate, and may answer the same grateful ends in seasoning its banquet that spices do in heightening ours.

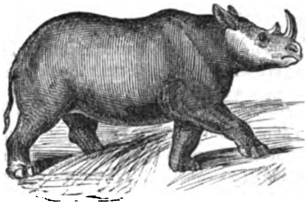
In some parts of the kingdom of Asia, where the natives are more desirous of appearing warlike than showing themselves brave, these animals are tamed, and led into the field to strike terror into the enemy; but they are always an unmanageable and restive animal, and probably more dangerous to the employers than those whom they are brought to oppose.

The method of taking them is chiefly watching them, till they are found either in some moist or marshy place, where, like hogs, they are fond of sleeping and wallowing. They then destroy the old one with fire-arms; for no weapons that are thrown by the force of men are capable of entering this animal's hide. If, when the old one is destroyed, there happens to be a cub, they seize and tame it: these animals are sometimes taken in pit-falls covered with green branches, laid in those paths which the rhinoceros makes in going from the forest to the river side.

There are some varieties in this animal, as in most others; some of them are found in Africa with a double horn, one growing above the other.[1] This weapon, if considered in itself, is one of the strongest and most dangerous that nature furnishes to any part of the animal creation. The horn is entirely solid, formed of the hardest bony substance, growing from the upper maxillary bone, by so strong an apophyse, as seemingly to make but one part with it. Many are the medicinal virtues that are ascribed to this horn, when taken in powder; but these qualities have been attributed to it without any real foundation, and

---

[1] *The two-horned rhinoceros.*—This species of the rhinoceros differs from the other in the appearance of its



skin; which, instead of vast and regularly marked folds resembling armour, has merely a slight wrinkle across the shoulders and the hinder parts, with a few fainter wrinkles on the sides; so that, in comparison with the common rhinoceros, it appears almost smooth. The principal distinction, however, consists in the nose being furnished with two horns, one of which is smaller than the other, and situated above it. These horns are said to be loose when the animal is in a quiet state, but when he is angry, they become firm and immovable. Le Vaillant asserts, that when these animals are at rest, they always place themselves in the direction of the wind, with their noses towards it, in order to discover by their smell the approach of any enemies. When irritated they tear up the ground furiously with their horns, throwing the earth and stones to a vast distance over their heads.

It is remarkable, that the two-horned variety has never in modern times been brought to Europe; yet it was much better known than the Asiatic variety to the ancients. It is generally represented with two horns in the coins and sculptures of the Romans. The one-horned variety seems to have been earlier known than the other, though it did not afterwards become such an object of familiar knowledge to the Romans. It is probably, also, the Indian ass with one horn, mentioned by Aristotle. Pompey introduced it into the games of the Roman circus; but, from the time of the fall of the Roman empire, it was so completely lost sight of, that, prior to the 16th century, naturalists were of opinion that it had never existed, or that if so, it was extinct. When, however, the Portuguese doubled the Cape of Good Hope, and opened the way to India, the one-horned variety again became known, and specimens were brought to Europe; the first was in the year 1513; but the first that appeared in England was not until 1684. They have never been very common, however, as objects of curiosity in Europe. A male one-horned rhinoceros was exhibited in London, Glasgow, and Edinburgh, in 1835-6. He was brought from Bengal, weighed two tons, and was said to be then six years old. He was bought by the Liverpool Zoological Society.

make only a small part of the many fables which this extraordinary animal has given rise to.[1]

CHAP. IV.

THE HIPPOPOTAMUS.

(*See Plate XII. fig.* 48.)

The Hippopotamus is an animal as large, and not less formidable, than the rhinoceros; its legs are shorter, and its head rather more bulky than that of the animal last described. We have had but few opportunities in Europe of examining this formidable creature minutely; its dimensions, however, have been pretty well ascertained, by a description given us by Zerenghi, an Italian surgeon, who procured one of them to be killed on the banks of the river Nile. By his account it appears, that this terrible animal, which chiefly resides in the waters of that river, is above seventeen feet long from the extremity of the snout to the insertion of the tail; above sixteen feet in circumference round the body, and above seven feet high: the head is near four feet long, and above nine feet in circumference. The jaws open about two feet wide, and the cutting-teeth, of which it hath four in each jaw, are above a foot long.[2]

Its feet, in some measure, resemble those of the elephant, and are divided into four parts. The tail is short, flat, and pointed;

---

[1] *The unicorn.*—Mr Edward Ruppell, who has resided during six successive years in the north-eastern regions of Africa, has published several numbers of a work illustrative of the natural history of these regions. He obtained in Nubia and Kordofan five specimens of rhinouri, two of which were males and three females. He regards the horns as constituting the principal generic character, they being formed by distinct bones, united to the frontal and parietal bones, by a very obvious suture, and having throughout the same structure with the other bones. In both sexes one of these abnormal bones is situated on each branch of the coronal suture, and the male possesses an additional one placed more anteriorly, and occupying the middle of the frontal suture. The anomalous position of this appendage furnishes a complete refutation of the theory of Camper with regard to the unicorn, that such an occurrence was contrary to nature, and proves at least the possibility of the existence of such an animal. Mr Rupell also obtained some information in Kordofan respecting this much debated animal. It was stated to be of the size of a small horse, of the slender make of the gazelle, and furnished with a long, straight, slender horn in the male, which was wanting in the female. According to the statements made by various persons, it inhabits the deserts to the south of Kordofan, is uncommonly fleet, and comes only occasionally to the Koldagi Heive mountain or the borders of Kordofan—*Edinburgh New Philosophical Journal.*

Account of the Chiru, or Unicorn of the Himalayah Mountains.—Mr Hodgson's paper on the *Chiru* concerned the animal which has been so often mentioned as the unicorn of the Himalayah. The reports respecting this animal have been so numerous and concurring, and so borne out by the specimens of single horns sent down at various times to the Asiatic Society, and by Bhotea drawings of a deer-like animal with one horn springing from the centre of the forehead, that scepticism has been almost silenced by the variety and quantity of evidence. The skin and horns sent by Mr Hodgson were the spoils of an animal which died in the menagerie of the rajah of Nepal, to whom it was presented by the lama of Digurchi, whose pet it had been. The persons who brought the animal to Nepal informed Mr Hodgson that the favourite abode of the chiru is the Tingri Maidan, a fine plain or valley through which the Arun flows, and which is situated immediately beyond the snows of the Kooti pass; that in this valley beds of salt abound, to which the *Chirus* are said to resort in vast herds. They are represented as in the highest degree wild, and unapproachable by man, flying on the least alarm; but if opposed, assuming a bold and determined front. The male and female are said to present the same general appearance.

The living subject of Mr Hodgson's description presented none of those formidable attributes with which the tales of the Bhoteas had clothed the chiru. In form and size he offered the common character of the antelope tribe, lived chiefly on grass, and did not seem dissatisfied with his captivity, although his panting showed that even the climate of Nepal was oppressive to *him*; he at length sunk under a temperature which rarely exceeded 80° as a maximum at the commencement of the hot weather. Although timid, and on his guard *against* the approach of strangers, he would, when warily laid hold of, submit patiently to handling.

The general form of the animal was *graceful*, *like* that of other antelopes, and was adorned with their matchless eye. His colour was reddish or fawn on the upper, and white on the lower part of the body. His distinguishing characters were, first, long, sharp, black horns, having a wavy, triple curvature, with circular rings towards their base, which projected more before than behind; and, secondly, two tufts of hair projecting on the outer side of each nostril, together with an unusual quantity of bristles about the nose and mouth, and which gave to his head a somewhat thickened appearance. The hair of the animal resembles in texture that of all the trans-Himalayah animals which Mr Hodgson has had the opportunity of examining, being harsh and of a hollow appearance. "It was about two inches long, and so thick as to present to the hand a sense of solidity; and beneath lay a spare fleece of the softest wool."—*Arcana of Science*, 1828.

[2] The head of a hippopotamus has recently been brought to England, with all the flesh about it, in a high state of preservation. This amphibious animal was harpooned while in combat with a crocodile, in a lake in the interior of Africa. The head measures near four feet long and eight feet in circumference: the jaws open two feet wide, and the cutting-teeth, of which it has four in each jaw, are above a foot long and four inches in circumference. Its ears are not bigger than a terrier's, and are much about the same shape. This formidable and terrific creature, when full-grown, measures about seventeen feet long from the extremity of the snout to the insertion of the tail, above sixteen feet in circumference round the body, and stands above seven feet high. It runs with astonishing swiftness for its great bulk at the bottom of lakes and rivers, but not with as much ease on land. When excited, it puts forth its full strength, which is prodigious. At one

the hide is amazingly thick, and though not capable of turning a musket-ball, is impenetrable to the blow of a sabre; the body is covered over with a few scattered hairs of a whitish colour. The whole figure of the animal is something between that of an ox and a hog, and its cry is something between the bellowing of the one and the grunting of the other.

This animal, however, though so terribly furnished for war, seems no way disposed to make use of its prodigious strength against an equal enemy; it chiefly resides at the bottom of the great rivers and lakes of Africa, the Nile, the Niger, and the Zara; there it leads an indolent kind of life, and seems seldom disposed for action, except when excited by the calls of hunger. Upon such occasions, three or four of them are often seen at the bottom of a river, near some cataract, forming a kind of line, and seizing upon such fish as are forced down by the violence of the stream.[1]

In that element they pursue their prey with great swiftness and perseverance; they swim with much force, and remain at the bottom for thirty or forty minutes, without rising to take breath. They traverse the bottom of the stream, as if walking upon land, and make a terrible devastation where they find plenty of prey. But it often happens, that this animal's fishy food is not supplied in sufficient abundance; it is then forced to come upon land, where it is an awkward and unwieldy stranger; it moves but slowly, and as it seldom forsakes the margin of the river, it sinks at every step it takes; sometimes, however, it is forced by famine up into the higher grounds, where it commits dreadful havoc among the plantations of the helpless natives, who see their possessions destroyed, without daring to resist their invader. Their chief method is by lighting fires, striking drums, and raising a cry to frighten it back to its favourite element; and as it is extremely timorous upon land, they generally succeed in their endeavours. But if they happen to wound, or otherwise irritate it too closely, it then becomes formidable to all that oppose it: it overturns whatever it meets, and brings forth all its strength, which it seemed not to have discovered before that dangerous occasion. It possesses the same inoffensive disposition in its favourite element, that it is found to have upon land; it is never found to attack the mariners in their boats as they go up or down the stream; but should they inadvertently strike against it, or otherwise disturb its repose, there is much danger of its sending them at once to the bottom. "I have seen," says a mariner, as we find it in Dampier, "one of these animals open its jaw, and seizing a boat between its teeth, at once bite and sink it to the bottom. I have seen it, upon another occasion, place itself under one of our boats, and rising under it, overset it, with six men who were in it; who, however, happily received no other injury." Such is the great strength of this animal; and from hence, probably, the imagination has been willing to match it in combat against others more fierce, and equally formidable. The crocodile and shark have been said to engage with it, and yield an easy victory; but as the shark is only found at sea, and the hippopotamus never ventures beyond the mouth of fresh-water rivers, it is most probable that these engagements never occurred; it sometimes happens, indeed, that the princes of Africa amuse themselves with combats, on their fresh-water lakes, between this and other formidable animals; but whether the rhinoceros or the crocodile are of this number, we have not been particularly informed. If this animal be attacked on land, and find itself incapable of vengeance from the swiftness of its enemy, it immediately returns to the river, where it plunges in head foremost, and, after a short time, rises to the surface, loudly bellowing, either to invite or intimidate the enemy; but though the negroes will venture to attack the shark or the crocodile in their natural element, and there destroy them, they are too well apprised of the force of the hippopotamus to engage it; this animal, therefore, continues the uncontrolled master of the river, and all others fly from its approach, or become an easy prey.

As the hippopotamus lives upon fish and vegetables, so it is probable the flesh of terrestrial animals may be equally grateful; the natives of Africa assert, that it has often been found to devour children and other creatures that it was able to surprise upon land; yet, as it moves but slowly, almost every creature, endued with a common share of swiftness, is able to escape it; and this animal, therefore, seldom ventures from the river side, but when pressed by the necessities of hunger, or of bringing forth its young.

The female always comes upon land to bring forth, and it is supposed that she seldom produces above one at a time. Upon this occasion these animals are particularly timorous, and dread the approach of a terrestrial enemy; the instant the parent hears the slightest noise it dashes into the stream, and the young one is seen to follow it with equal alacrity.

---

time it was not uncommon in the Nile, but now it is no where to be found in that river, except above the cataracts.—*Mag. Nat. Hist.*

[1] The hippopotamus is herbivorous, and feeds only on roots and succulent stems of large aquatic plants. One species only is known.

The young ones are said to be excellent eating; but the negroes, to whom nothing that has life comes amiss, find an equal delicacy in the old. Dr Pococke has seen their flesh sold in the shambles like beef; and it is said that their breast, in particular, is as delicate eating as veal. As for the rest, these animals are found in great numbers, and as they produce very fast, their flesh might supply the countries where they are found, could those barbarous regions produce more expert huntsmen. It may be remarked, however, that this creature, which was once in such plenty at the mouth of the Nile, is now wholly unknown in Lower Egypt, and is no where to be found in that river except above the cataracts.

CHAP. V.

THE CAMELOPARD, [OR GIRAFFE.]

(*See Plate XIV. fig.* 9.)

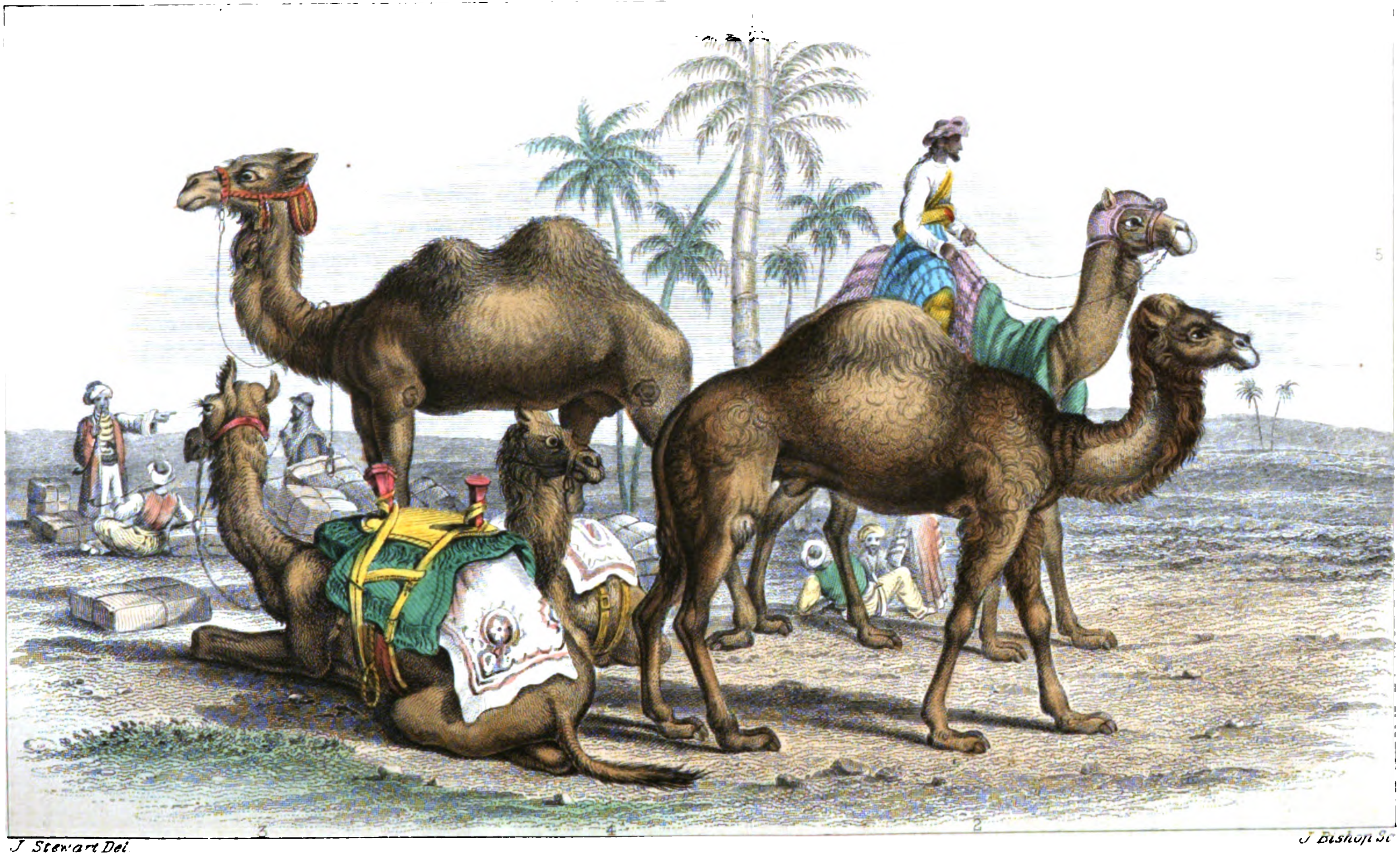
Were we to be told of an animal so tall, that a man on horseback could with ease ride under its belly, without stooping, we should hardly give credit to the relation; yet of this extraordinary size is the camelopard, an animal that inhabits the deserts of Africa, and the accounts of which are so well ascertained, that we cannot deny our assent to their authority. It is no easy matter to form an adequate idea of this creature's size, and the oddity of its formation. It exhibits somewhat the slender shape of the deer, or the camel, but is destitute of their symmetry, or their easy power of motion. The head somewhat resembles that of the deer, with two round horns, near a foot long, and which, it is probable, it sheds as deer are found to do; its neck resembles that of a horse; its legs and feet those of the deer, but with this extraordinary difference, that the fore-legs are near twice as long as the hinder. As these creatures have been found eighteen feet high, and ten from the ground to the top of the shoulder, so allowing three feet, for the depth of the body, seven feet remains, which is high enough to admit a man mounted on a middle-sized horse. The hinder part, however, is much lower, so that when the animal appears standing, at rest, it has somewhat the appearance of a dog sitting; and this formation of its legs gives it an awkward and a laborious motion, which, though swift, must yet be tiresome. For this reason the camelopard is an animal very rarely found, and only finds refuge in the most internal desert regions of Africa. The dimensions of a young one, as they were accurately taken by a person who examined its skin, that was brought from the Cape of Good Hope, were found to be as follows: the length of the head was one foot eight inches; the height of the fore-leg, from the ground to the top of the shoulder, was ten feet; from the shoulder to the top of the head was seven; the height of the hind-leg was eight feet five inches; and from the top of the shoulder to the insertion of the tail was just seven feet long.

No animal, either from its disposition, or its formation, seems less fitted for a state of natural hostility; its horns are blunt, and even knobbed at the ends; its teeth are made entirely for vegetable pasture; its skin is beautifully speckled with brown spots, upon a whitish ground; it is timorous and harmless, and, notwithstanding its great size, rather flies from, than resists, the slightest enemy; it partakes very much of the nature of the camel, which it so nearly resembles; it lives entirely upon vegetables, and when grazing, is obliged to spread its fore-legs very wide in order to reach its pasture; its motion is a kind of pace, two legs on each side moving at the same time, whereas in other animals they move transversely. It often lies down with its belly to the earth, and, like the camel, has a callous substance upon its breast, which, when reposed, defends it from injury. This animal was known to the ancients, but has been very rarely seen in Europe. One of them was sent from the East to the Emperor of Germany, in the year 1559; but they have often been seen tame at Grand Cairo in Egypt; and, I am told, there are two there at present. When ancient Rome was in its splendour, Pompey exhibited at one time no less than ten upon the theatre. It was the barbarous pleasure of the people, at that time, to see the most terrible, and the most extraordinary animals, produced in combat against each other. The lion, the lynx, the tiger, the elephant, the hippopotamus, were all let loose promiscuously, and were seen to inflict indiscriminate destruction.[1]

---

[1] It was not till within the last fifty years that we obtained any very precise notions of the form and habits of the camelopard or giraffe; and we principally owe them to Le Vaillant, who saw the animal in a natural state, and whose narrative was originally considered, in some degree, fabulous, but its accuracy has since been abundantly confirmed.

"The giraffe ruminates," he says, "as every animal does that possesses, at the same time, horns and cloven feet. It grazes also in the same way, but not often, because the country which it inhabits has little pasturage. Its ordinary food is the leaf of a sort of mimosa, called by the natives *kanaap*, and by the colonists, *kameel-doorn*. This tree being only found in the country of the Namaquas, may probably afford a reason why the giraffe is there fixed, and why he is not seen in those regions of Southern Africa where the tree does not grow. Doubtless, the most beautiful part of his body is



J Stewart Del.

J Bishop Sc

1. BACTRIAN CAMEL. 2 ARABIAN CAMEL OR DROMEDARY 3 4 DROMEDARIES CAPARISONED
5 POST CAMEL OF INDIA

[illegible]

CHAP. VI.

THE CAMEL AND THE DROMEDARY.[1]

(*For representation of Bactrian Camel, see Plate XIII. fig.* 62.)

These names do not make two distinct kinds, but are only given to a variety of the same animal, which has, however, subsisted time immemorial. The principal, and perhaps the only sensible difference, by which those two races are distinguished, consists in this, that the camel has two bunches upon his back,

---

the head. The mouth is small; the eyes are brilliant, and full. Between the eyes, and above the nose, is a swelling, very prominent and well defined. This prominence is not a fleshy excrescence, but an enlargement of the bony substance; and it seems to be similar to the two little lumps, or protuberances, with which the top of his head is armed, and which, being about the size of a hen's egg, spring, on each side, at the commencement of the mane. His tongue is rough, and terminates in a point. The two jaws have, on each side, six molar teeth; but the lower jaw has, beyond these, eight incisive teeth, while the upper jaw has none. The hoofs, which are cleft, and have no nails, resemble those of the ox. We may remark, at first sight, that those of the fore feet are larger than those of the hind. The leg is very slender, but the knees have a prominence, because the animal kneels when he lies down. There is also a larger callosity on the breast, which would lead one to conclude that he generally rests on that part.

"If I had not myself killed the giraffe, I should have believed, as have many naturalists, that the fore legs are much longer than the hind. This is an error; for the legs have, in general, the proportion of those of other quadrupeds. I say in general, because in this genus there are varieties, as there are in animals of the same species. Thus, for example, mares are lower before than stallions of an equal height. What has led to this error, as to the difference between the legs of the giraffe, is the height of the withers, which, according to the animal's age, may exceed the height of the rump, by sixteen or twenty inches, and which disproportion, when we see it at a distance, must have led to the belief that its legs are longer before than behind. . . . . . His defence, as that of the horse and other hoofed animals, consists in kicks; and his hinder limbs are so light, and his blows so rapid, that the eye cannot follow them. They are sufficient for his defence against the lion. He never employs his horns in resisting any attack. . . . The giraffes, male and female, resemble each other in their exterior, in their youth. Their obtuse horns are then terminated by a knot of long hair: the female preserves this peculiarity some time, but the male loses it at the age of three years. The hide, which is at first of a light red, becomes of a deeper colour as the animal advances in age, and is at length of a yellow brown in the female, and of a brown approaching to black in the male. By this difference of colour the male may be distinguished from the female at a distance. The skin varies in both sexes, as to the distribution and form of the spots. The female is not so high as the male, and the prominence of the front is not so marked. She has four teats. According to the account of the natives, she goes with young about twelve months, and has one at a birth."

In 1835, four giraffes were brought to the Zoological Gardens at London by M. Thibaut, who, in a letter to the secretary of the society, gives an interesting account of them.

"The first run of the giraffe," he says, "is exceedingly rapid. The swiftest horse, if unaccustomed to the desert, could not come up with it unless with extreme difficulty. The Arabs accustom their coursers to hunger and to fatigue; milk generally serves them for food, and gives them power to continue their exertions during a very long run. If the giraffe reaches a mountain, it passes the heights with rapidity: its feet, which are like those of a goat, endow it with the dexterity of that animal: it bounds over ravines with incredible power; horses cannot, in such situations, compete with it.

"The giraffe is fond of a wooded country. The leaves of trees are its principal food. Its conformation allows of its reaching their tops.

"The giraffe eats with great delicacy and takes its food leaf by leaf, collecting them from the trees by means of its tongue. It rejects the thorns, and in this respect it differs from the camel. Great care is required for its preservation, and especially great cleanliness.

"It is extremely fond of society, and is very sensible. I have observed one of them shed tears when it no longer saw its companions, or the persons who were in the habit of attending to it.

"I was so fortunate as to collect five individuals at Kordofan; but the cold weather of December, 1834, killed four of them in the desert on the route to Dongolah, my point of departure for Bebbah. Only one was preserved; this was the first specimen that I obtained, and the one of which I have already spoken. After twenty-two days in the desert, I reached Dongolah on the 6th of January, 1835.

"Unwilling to return to Cairo without being really useful to the society, and being actually at Dongolah, I determined on resuming the pursuit of giraffes. I remained for three months in the desert, crossing it in all directions. Arabs in whom I could confide accompanied me, and our course was through districts destitute of everything. We had to dread the Arabs of Darfour, of which country I saw the first mountain. We were successful in our researches. I obtained three giraffes, smaller than the one I already possessed. Experience suggested to me the means of preserving them.

"Another trial was reserved for me:—that of transporting the animals, by bark, from Wadi Halfa to Cairo, Alexandria, and Malta. Providence has enabled me to surmount all difficulties. The most that they suffered was at sea, during their passage, which lasted twenty-four days, with the weather very tempestuous.

"I arrived at Malta on the 21st of November. We were there detained in quarantine for twenty-five days,

[1] These quadrupeds have six front teeth in the lower jaw, which are rather thin and broad: the canine teeth are a little remote from the rest; in the upper jaw there are three, in the lower two: the upper lip divided; and there are no horns.

whereas the dromedary has but one; the latter, also, is neither so large, nor so strong, as the camel. These two races, however, produce with each other, and the mixed breed formed between them is considered the best, the most patient, and the most indefatigable of all the kind.[1]

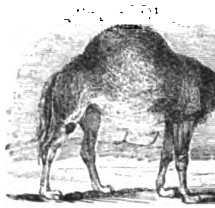
Of the two varieties, the dromedary is by far the most numerous, the camel being scarcely found, except in Turkey, and the countries of the Levant; while the other is found spread over all the deserts of Arabia, the southern parts of Africa, Persia, Tartary, and a great part of the eastern Indies. Thus, the one inhabits an immense tract of country, the other, in comparison, is confined to a province; the one inhabits the sultry countries of the torrid zone, the other delights in a warm, but not a burning climate; neither, however, can subsist, or propagate, in the variable climates toward the north; they seem formed for those countries where shrubs are plenty, and water scarce; where they can travel along the sandy desert without being impeded by rivers, and

---

after which, through the kind care of Mr Bourchier, these valuable animals were placed in a good situation, where nothing is wanting for their comfort. With the view of preparing them for the temperature of the country to which they will eventually be removed, I have not thought it advisable that they should be clothed During the last week the cold has been much greater than they have hitherto experienced; but they have, thanks to the kindness of Mr Bourchier, everything that can be desired.

"These four giraffes, three males and one female, are so interesting and so beautiful, that I shall exert myself to the utmost to be of use to them. It is possible that they may breed; already I observe in them some tendency towards mutual attachment. They are capable of walking for six hours a-day without the slightest fatigue. —G. T."

To convey these beautiful animals from Malta to London, the society made arrangements with the proprietors of the Manchester steam-vessel, engaged at that time in the service of the Prince of Portugal, to proceed, after her discharge at Lisbon, to Malta, and there take them on board, proper accommodations having been fitted up for them. By this vessel they arrived in London on the 23rd of May, and were placed in a temporary place of security, whence in the early part of the morning of the 25th, at about three o'clock, they set out to walk to their final destination, the gardens in Regent's Park. Accompanied by M. Thibaut, and several Nubian attendants, they proceeded quietly along, led by halters, without evincing the least show of resistance or alarm; indeed their gentleness and docility were beyond expectation. Few persons at that early hour were abroad, but those who met them on the road gazed with wonder on the novel spectacle—four tall strange animals moving along, or every now and then stopping to gaze around them, stretching out their long necks to their full extent, led by Nubian keepers, dressed in their Abyssinian costume, together with a mingled retinue of attendants, the whole forming a singular and striking cavalcade. Arrived at the gardens they entered their dwelling without the slightest difficulty; nor did the novelty of their situation, or the presence of strangers, in the least disturb them. It must not be supposed that the gentleness thus manifested arose from weakness or fatigue; on the contrary, they were in excellent health and condition, with their spotted coats smooth and glossy, and as playful as fawns, animation sparkling in their large dark eyes, and every action evincing ease and activity. Their walk is quick, and they get over the ground well, but there is something apparently awkward in their pace, owing to the shortness of the body, and to the circumstance of the hind feet passing the fore feet by two hands' breadth at every step, and that a little to the outside, while the neck is carried obliquely, the line of direction running from the haunches to the withers, and thence forward to the head without any angle.



[1] Camels are of two species. That with one hump, which is represented below, is the Arabian camel, and is usually called the dromedary. The species with two humps is the Bactrian camel. (See Plate XIII. fig. 62.) The Asiatics and Africans distinguish as dromedaries those camels which are used for riding. There is no essential difference in the species, but only in the breed. The camel of the heavy caravan, the baggage camel, may be compared to the dray-horse; the dromedary to the hunter, and, in some instances, to the race-horse. Messengers on dromedaries, according to Burckhardt, have gone from Daraou to Berber in eight days, while he was twenty-two days with the caravan on the same journey. Mr Jackson, in his account of the empire of Morocco, tells a romantic story of a swift dromedary, whose natural pace was accelerated in an extraordinary manner by the enthusiasm of his rider: "Talking with an Arab of Suse, on the subject of these fleet camels, and the desert horse, he assured me that he knew a young man who was passionately fond of a lovely girl, whom nothing would satisfy but some oranges; these were not to be procured at Mogadore, and, as the lady wanted the best fruit, nothing less than Morocco oranges would satisfy her. The Arab mounted his heirie at dawn of day, went to Morocco (about one hundred miles from Mogadore), purchased the oranges, and returned that night after the gates were shut, but sent the oranges to the lady by a guard of one of the batteries."

The training of the camels to bear burthens, in the countries of the East, has not been *minutely* described by any traveller. M. Brue, who, at the latter part of the seventeenth century, had the management of the affairs of a French commercial company at Senegal, says, "soon after a camel is born, the Moors tie his feet under his belly, and having thrown a large cloth over his back, put heavy stones at each corner of the cloth, which rests on the ground. They in this manner accustom him to receive the heaviest loads." Both ancient and modern authors agree tolerably well in their accounts of the load which a camel can carry. Sandys, in his Travels in the Holy Land, says, "six hundred weight is his ordinary load, yet will he carry a thousand." The caravans are distinguished as *light* or *heavy*, according to the load which the camels bear. The average load of the heavy, or slow-going camel, as stated by Major Rennell, who investigated their rate of travelling with great accuracy, is from 500 to 600 lbs. Burckhardt says, that his luggage and provisions weighing only 2 cwt., and his camel being capable of carrying 6 cwt., find food at expected distances; such a country is Arabia, and this, of all others, seems the most adapted to the support and production of this animal.

The camel is the most temperate of all animals, and it can continue to travel several days without drinking. In those vast deserts, where the earth is everywhere dry and sandy, where there are neither birds nor beasts, neither insects nor vegetables, where nothing is to be seen but hills of sand and heaps of stone, there the camel travels, posting forward, without requiring either drink or pasture, and is often found six or seven days without any sustenance whatsoever. Its feet are formed for travelling upon sand, and utterly unfit for moist or marshy places; the inhabitants, therefore, find a most useful assistant in this animal, where no other could subsist, and by its means cross those deserts with safety, which would be unpassable by any other method of conveyance.

An animal, thus formed for a sandy and desert region, cannot be propagated in one of a different nature. Many vain efforts have been tried to propagate the camel in Spain; they have been transported into America, but have multiplied in neither. It is true, indeed, that they may be brought into these countries, and may, perhaps, be found to produce there; but the care of keeping them is so great, and the accidents to which they are exposed, from the changeableness of the climate, are so many, that they cannot answer the care of keeping. In a few years also they are seen to degenerate; their strength and their patience forsake them; and instead of making the riches, they become the burden of their keepers.[1]

But it is very different in Arabia, and those countries where the camel is turned to useful purposes. It is there considered as a sacred animal, without whose help the natives

---

he sold him, contracting for the transport of his luggage across the desert. The camel sometimes carries large panniers, filled with heavy goods; sometimes bales are strapped on his back, fastened either with cordage made of the palm-tree, or leathern thongs; and sometimes two, or more, will bear a sort of litter, in which women and children ride with considerable ease.

[1] Of all animals, the camel perhaps is most exactly adapted both to those peculiar regions of the earth in which it is principally if not exclusively found, and to those purposes for which it is usually employed by man: to whose wants indeed it is so completely accommodated, and apparently so incapable of existing without his superintendence, that while on the one hand we find the camel described in the earliest records of history, and in every subsequent period, as in a state of subjugation to man, and employed for precisely the same purposes as at the present day: on the other hand, it does not appear that the species has ever existed in a wild or independent state.

With scarcely any natural means of defence, and nearly useless in the scheme of creation (as far as we can judge), unless as the slave of man, it forms a remarkable parallel to the sheep, the ox, and other of the ruminating species; which are also rarely, if ever, found, but under the protection of man, and to that protection are indebted, indeed, for their existence as a distinct species. Let us compare, then, the form and structure, and moral qualities of the camel, with the local character of the regions in which it is principally found; and with the nature of the services exacted of it by man.

The sandy deserts of Arabia are the classical country of the camel; but it is also extensively employed in various other parts of Asia, and in the north of Africa; and the constant communication that exists between the tribes which border on the intervening sea of sand, could only be maintained by an animal possessing such qualities as characterise the camel—"the ship of the desert," as it has emphatically been called. Laden with the various kinds of merchandise which are the object of commerce in that region of the world, and of which a part often passes from the most easterly countries of Asia to the extreme limits of western Europe, and from thence even across the Atlantic to America, this extraordinary animal pursues its steady course over burning sands during many successive weeks. And not only is it satisfied with the scanty herbage which it gathers by the way, but often passes many days without meeting with a single spring of water in which to slake its thirst.

In explanation of its fitness as a beast of burden, for such tracts of sand, its feet and its stomach are the points in its structure which are principally calculated to arrest our attention: and its feet are not less remarkably accommodated to the road over which it travels, than is the structure of its stomach to the drought of the region through which that road passes. The foot of the camel, in fact, is so formed that the animal would be incapable of travelling, with any ease or steadiness, over either a rough or a stony surface; and equally incapable is it of travelling for any long continuance over moist ground, in consequence of the inflammation produced in its limbs from the effect of moisture. It is observed by Cuvier, that these circumstances in its physical history, and not the incapability of bearing a colder temperature, account for the fact, that, while the sheep, the ox, the dog, the horse, and some other species, have accompanied the migrations of man, from his aboriginal seat in central Asia to every inhabitable part of the globe, the camel still adheres to the desert.

And now observe how its interior structure meets the difficulty of a region where water is rarely found. As in the case of all other animals which ruminate or chew the cud, the stomach of the camel consists of several compartments; of which one is divided into numerous distinct cells, capable of collectively containing such a quantity of water as is sufficient for the ordinary consumption of the animal during many days. And, as opportunities occur, the camel instinctively replenishes this reservoir, and is thus enabled to sustain a degree of external drought, which would be destructive to all other animals but such as have a similar structure.

Of the two species of camel, the Bactrian and Arabian, the latter is that with the history of which we are best acquainted; and though there is reason to believe, that, whatever is said of the qualities of the one might with truth be affirmed of the other also, on the present occasion whatever is said is referable to the Arabian species. The camel not only consumes less food than the horse, but can sustain more fatigue. A large camel is capable of carrying from seven to twelve hundred-weight, and travelling with that weight on its back at the rate of above ten leagues in each day. The small courier camel, carrying no weight, will travel thirty leagues in each day, provided the ground be dry and level. Individuals of each variety will subsist for eight could neither subsist, traffic, or travel; its milk makes a part of their nourishment; they feed upon its flesh, particularly when young; they clothe themselves with its hair, which it is seen to moult regularly once a-year; and if they fear an invading enemy their camels serve them in flight, and in a single day they are known to travel above a hundred miles. Thus, by means of the camel, an Arabian finds safety in his deserts; all the armies upon earth might be lost in the pursuit of a flying squadron of this country mounted upon their camels, and taking refuge in solitudes, where nothing interposes to stop their flight, or to force them to wait the invader. Nothing can be more dreary than the aspect of these sandy plains, that seem entirely forsaken of life and vegetation: wherever the eye turns, nothing is presented but a sterile and dusty soil, sometimes torn up by the winds, and moving in great waves along, which, when viewed from an eminence, resembles less the earth than the ocean; here and there a few shrubs appear, that only teach us to wish for the grove—that remind us of the shade in these sultry climates, without affording its refreshment; the return of morning, which, in other places, carries an idea of cheerfulness, here serves only to enlighten the endless and dreary waste, and to present the traveller with an unfinished prospect of his forlorn situation: yet in this chasm of nature, by the help of the camel, the Arabian finds safety and subsistence. There are here and there found spots of verdure, which, though remote from each other, are, in a manner, approximated by the labour and industry of the camel. Thus these deserts, which present the stranger with nothing but objects of danger and sterility, afford the inhabitant protection, food, and liberty. The Arabian lives independent and tranquil in the midst of his solitudes; and,

---

or ten successive days on dry thorny plants; but after this period require more nutritious food, which is usually supplied in the form of dates and various artificial preparations; though, if not so supplied, the camel will patiently continue its course, till nearly the whole of the fat, of which the boss on its back consists, is absorbed; whereby that protuberance becomes as it were obliterated.

The camel is equally patient of thirst as of hunger; and this happens, no doubt, in consequence of the supply of fluid which it is capable of obtaining from the peculiar reservoir contained in its stomach. It possesses moreover a power and delicacy in the sense of smell (to that sense at least such a power is most naturally referable,) by which, after having thirsted for seven or eight days, it perceives the existence of water at a very considerable distance; and it manifests this power by running directly to the point where the water exists. It is obvious that this faculty is exerted as much to the benefit of their drivers, and the whole suite of the caravan, as of the camels themselves.

Such are some of the leading advantages derived to man from the physical structure and powers of this animal; nor are those advantages of slight moment which are derived from its docile and patient disposition. It is no slight advantage, for instance, considering the great height of the animal, which usually exceeds six or seven feet, that the camel is easily taught to bend down its body on its limbs in order to be laden; and, indeed, if the weight to be placed on its back be previously so distributed as to be balanced on an intervening yoke of a convenient form, it will spontaneously direct its neck under the yoke, and afterwards transfer the weight to its back. St Hilaire and Cuvier, from whom the substance of much of the preceding account is taken, assert, that, if after having laid down and received the intended freight, the camel should find it inconveniently heavy, it will not rise till a part has been taken off; and that when fatigued by long travel, it will proceed more readily and easily if the driver sing some familiar tune. This, however, is a quality not peculiar to the camel.

Considered only thus far in its history, the camel easily stands pre-eminent, as the most useful, among all the species of ruminating animals, in the bodily or mechanical services which it renders to man; it is almost indeed the rival of the horse, even when compared in a general point of view; but more than its rival in its particular arena, the desert. The reindeer assists the individual wants of the Laplander by conveying his sledge over the frozen surface of the snow; and the ox, on a more enlarged scale of labour, is employed in some countries in ploughing, or in the draught of heavy weights; but the camel was from time immemorial, up to a comparatively recent period, almost the sole intermedium of the principal part of the commerce of the whole world. Thus the spices and other rich merchandise of the East, being brought to the confines of Arabia, were conveyed on the backs of camels across the desert, and thence finding their way to the trading cities of Phœnicia, while they yet flourished—and subsequently, after their destruction or decay, to Alexandria—they were distributed over the continent of Europe, enriching whole nations by the profits of the mere transfer; for thus Venice became not only the mistress of the Adriatic and Mediterranean, but in a measure the arbitress of the whole world.

Although the route by the Cape has in a great measure superseded that by Alexandria, the commercial intercourse carried on by means of the camel between opposite confines of the African and Asiatic deserts, is still sufficiently extensive to make the importance of that animal very considerable; so that even now, as ages and ages since, the riches of an individual are estimated by the number of camels he may possess; and he still uses his camels either in war, or for the transport of merchandise, or for the purpose of selling them.

But it would be found, upon pursuing the history of the camel, that, while under the point of view which has been just considered, this animal contributes more largely to the advantages of mankind than any other species of the ruminating order, it scarcely is inferior to any one of those species with respect to other advantages, on account of which they are principally valuable. Thus the Arab obtains from the camel not only milk and cheese, and butter, but he ordinarily also eats its flesh, and fabricates its hair into clothing of various kinds. The very refuse indeed of the digested food of the animal is the principal fuel of the desert; and from the smoke of this fuel is obtained the well-known substance called *sal ammoniac*, which is very extensively employed in the arts; and of which indeed, formerly, the greater part met with in commerce was obtained from this source alone, as may be implied from its very name.—*Kidd's Bridgewater Treatise.*

instead of considering the vast solitudes spread round him as a restraint upon his happiness, he is, by experience, taught to regard them as the ramparts of his freedom.

The camel is easily instructed in the methods of taking up and supporting his burden; their legs, a few days after they are produced, are bent under their belly; they are in this manner loaded, and taught to rise; their burden is every day thus increased, by insensible degrees, till the animal is capable of supporting a weight adequate to its force: the same care is taken in making them patient of hunger and thirst: while other animals receive their food at stated times, the camel is restrained for days together, and these intervals of famine are increased in proportion as the animal seems capable of sustaining them. By this method of education they live five or six days without food or water; and their stomach is formed most admirably by nature to fit them for long abstinence; besides the four stomachs, which all animals have that chew the cud, (and the camel is of the number,) it has a fifth stomach, which serves as a reservoir, to hold a greater quantity of water than the animal has an immediate occasion for. It is of a sufficient capacity to contain a large quantity of water, where the fluid remains without corrupting, or without being adulterated by the other aliments: when the camel finds itself pressed with thirst, it has here an easy resource for quenching it; it throws up a quantity of this water, by a simple contraction of the muscles, into the other stomachs, and this serves to macerate its dry and simple food; in this manner, as it drinks but seldom, it takes in a large quantity at a time, and travellers, when straitened for water, have been often known to kill their camels for that which they expected to find within them.

In Turkey, Persia, Arabia, Barbary, and Egypt, their whole commerce is carried on by means of camels; and no carriage is more speedy, and none less expensive, in these countries. Merchants and travellers unite themselves into a body, furnished with camels, to secure themselves from the insults of the robbers that infest the countries in which they live. This assemblage is called a *caravan*, in which the numbers are sometimes known to amount to above ten thousand, and the number of camels is often greater than those of the men: each of these animals is loaded according to his strength, and he is so sensible of it himself, that when his burden is too great, he remains still upon his belly, the posture in which he was laden, refusing to rise, till his burden be lessened or taken away. In general, the large camels are capable of carrying a thousand weight, and sometimes twelve hundred; the dromedary, from six to seven. In these trading journeys, they travel but slowly, their stages are generally regulated, and they seldom go above thirty, or at most about five and thirty miles a-day. Every evening, when they arrive at a stage, which is usually some spot of verdure, where water and shrubs are in plenty, they are permitted to feed at liberty; they are then seen to eat as much in an hour as will supply them for twenty-four; they seem to prefer the coarsest weeds to the softest pasture: the thistle, the nettle, the cassia, and other prickly vegetables, are their favourite food; but their drivers take care to supply them with a kind of paste composition, which serves as a more permanent nourishment. As these animals have often gone the same track, they are said to know their way precisely, and to pursue their passage when their guides are utterly astray; when they come within a few miles of their baiting-place, in the evening, they sagaciously scent it at a distance, and increasing their speed, are often seen to trot with vivacity to their stage.

The patience of this animal is most extraordinary; and it is probable that its sufferings are great; for when it is loaded it sends forth most lamentable cries, but never offers to resist the tyrant that oppresses it. At the slightest sign it bends its knees and lies upon its belly, suffering itself to be loaded in this position; by this practice, the burden is more easily laid upon it than if lifted up while standing; at another sign it rises with its load, and the driver getting upon its back between the panniers, which, like hampers, are placed upon each side, he encourages the camel to proceed with his voice and with a song. In this manner the creature proceeds contentedly forward with a slow uneasy walk, of about four miles an hour, and when it comes to its stage lies down to be unloaded as before.

Mr Buffon seems to consider the camel to be the most domesticated of all other creatures, and to have more marks of the tyranny of man imprinted on its form. He is of opinion that this animal is not now to be found in a state of nature; that the humps on its back, the callosities upon its breast and its legs, and even the great reservoir for water, are all marks of long servitude and domestic constraint. The deformities he supposes to be perpetuated by generation; and what at first was accident at last becomes nature. However this be, the humps upon the back grow large in proportion as the animal is well fed, and if examined, they will be found composed of a substance not unlike the udder of a cow.

The inhabitants generally leave but one

male to wait on ten females, the rest they castrate; and though they thus become weaker, they are more manageable and patient. The female receives the male in the same position as when these animals are loaded; she goes with young for about a year, and like all other great animals, produces but one at a time. The camel's milk is abundant and nourishing, and mixed with water makes a principal part of the beverage of the Arabians. These animals begin to engender at three years of age, and they ordinarily live from forty to fifty years. The genital part of the male resembles that of the bull, but it is placed pointing backwards, so that its urine seems to be ejected in the manner of the female. This, as well as the dung, and almost every part of this animal, is converted to some useful purpose by the keepers. Of the urine, sal ammoniac is made; of the dung, litter for the horses, and fire for the purpose of dressing their victuals. Thus, this animal alone seems to comprise within itself a variety of qualities, any one of which serves to render other quadrupeds absolutely necessary for the welfare of man: like the elephant it is manageable and tame; like the horse, it gives the rider security; it carries greater burdens than the ox or the mule, and its milk is furnished in as great abundance as that of the cow; the flesh of the young ones is supposed to be as delicate as veal; their hair is more beautiful, and more in request than wool; while even of its very excrements no part is useless.

CHAP. VII.

THE LLAMA.[1]

(*For White Llama, see Plate XIII. fig.* 51.)

As almost all the quadrupeds of America are smaller than the resembling ones of the ancient continent, so the llama, which may be considered as the camel of the new world, is every way less than that of the old. This animal, like that described in the former chapter, stands high upon its legs, has a long neck, a small head, and resembles the camel, not only in its natural mildness, but its aptitude for servitude, its moderation, and its patience. The Americans early found out its useful qualities, and availed themselves of its labours: like the camel, it serves to carry goods over places inaccessible to other beasts

---

[1] The llamas and the camels, alone of all the ruminants, have their hoofs formed on a different plan from that which generally pervades the tribe. Instead of having short and abruptly truncated toes, completely enveloped in large hoofs, flattened internally, and forming the sole basis on which the animal rests in progression, these groups have their toes elongated forwards and terminating in small horny appendages, surrounding the last phalanx alone, rounded above and on either side, and somewhat curved, while the under surface of the foot on which they tread is covered only by a thickened callous skin. This striking deviation from the typical form is not, however, unaccompanied by differences in the structure of the stomachs, which, although truly and essentially ruminant, have in this case an additional developement of a very remarkable character. One of the most useful peculiarities of the camel, its power of passing many days without drinking, has long since been recognised as dependent on a cellular apparatus connected with the first and second stomachs, and capable, to quote the expressions of M. Cuvier, "of retaining water or of continually producing it." But the existence of a similar apparatus in the stomach of the llamas has been repeatedly denied: Feuillee, in his minute account of the anatomy of this organ, takes no notice of such an appendage, and Sir Everard Home expressly states that the corresponding pits in the stomach of the llama "have no depth, are only superficial cells, and have no muscular apparatus to close their mouths." From an external examination of the stomach of a llama we had been induced to believe that its cells were of considerable depth: and Dr Knox has recently confirmed this opinion in a paper published in the Edinburgh Journal of Natural and Geographical Science, where he has shown that the actual differences between the stomachs of the llama and the camel are much less than had previously been imagined. Hence we are authorized in inferring that the llamas, which are known to possess a similar capability of resisting thirst, are furnished with the same means of providing against its effects.

The camels and the llamas differ from the rest of the ruminants in several other striking particulars. They are entirely destitute of horns, an exemption which they share with the genus moschus, as at present constituted, and which, according to some writers, is compensated by the presence of two incisor teeth in the upper jaw, which they alone possess, and by the greater developement of the canine teeth in the same jaw, which they exhibit in common with many others of the tribe. Their dentition is in fact peculiar to themselves. The real character of the incisors of the upper jaw is indicated only by their position in the intermaxillary bone, for they are placed at some distance from each other and have exactly the shape of canines; the true canines are considerably larger; and the cheek-teeth form a regular series like those of the generality of ruminants, but consisting of only two false and three true molars. In the lower jaw there are but six incisors, the two outermost of the series having all the character of canines, and being fully as large as those of the upper; and the cheek-teeth consist of but one false molar and three true ones. The camels have in addition a small rudimentary false molar, having the conical form of the canines, and placed in the interval between the latter and the cheek-teeth, on each side of either jaw.

Of the remaining characters common to the camels and the llamas the most important are the length of the neck; the comparatively small size of the head; the prolongation and mobility of the upper lip, which is deeply divided by a vertical fissure; and the want of a naked muzzle, the openings of the nostrils forming merely two transverse fissures in the skin, capable of being closed at pleasure. The distinguishing characters between the two groups are chiefly founded on the difference in dentition just noticed; on the presence of a broad callous sole connecting the toes of the camels beneath, which is wanting in the llamas, whose toes are completely separated from each other; and on the existence of one or more large fatty humps on the backs of the camels, while the llamas have the line of their backs perfectly straight, or at the utmost forming a slight protuberance above the shoulders. The first and the last of these differences are not, it is true, of primary importance; but the second is closely connected with the habits of the animals, rendering the one group peculiarly fitted for traversing the sandy deserts of its native land, and the other for mounting and descending the lofty precipices among which its abode is fixed.

It may therefore be considered without hesitation sufficiently essential for the establishment of a generic distinction, where the laws of geographical distribution have drawn so broad a line of demarcation, confining the one group to the arid deserts of the East, and fixing the other on the ridges of the mountain chain that traverses the southern division of the Western Hemisphere. They deserve this distinction at least as well as the hogs and the peccaries, or as several other genera which have been admitted by common consent as distinguishing the animals of the Old World and of the New.

In general appearance the llamas present a striking contrast to their eastern representatives. Their slender and well formed legs bear a much more equal proportion to the size and form of their body, which cannot be better compared than to that of the common stag. Their necks, although in stooping they descend into a deep concavity on the upper side, are more habitually maintained in an upright position, and support much smaller and more graceful heads. Their ears are long, pointed, and extremely movable; their eyes large, prominent, and brilliant, and the whole expression of their physiognomy conveys a degree of intelligence and vivacity for which we should look in vain in the heavy, stupid, indolent, and unexpressive features of the camel or the dromedary. Their motions too are infinitely more graceful, their manners more frank and confiding, and their tempers, generally speaking, more docile and familiar. Such at least is the case with those which have been long retained in a state of domestication: the wild ones are at first more shy and exhibit occasional symptoms of violence, but good treatment soon reduces them to an almost equal tameness with their fellows. This facility of domestication, according to the theory of M. F. Cuvier, is dependent on their propensity for associating in herds, which may undoubtedly constitute a principal reason for the fact; but even in such animals, and of the ruminant order, there is too much diversity in this respect to allow of our regarding the instinct of associations as the only cause of their familiarity with man.

Zoologists are by no means agreed with respect to the number of species of this group. The early travellers in America speak vaguely of the llama, the guanaco, the paco or alpaco, and the vicugna, but without indicating any tangible differences between them, and frequently, it would seem, without considering them as distinct. Until within the last half century the great majority of naturalists, including Ray, Klein, Brisson, and Linnæus, concurred in reducing them to two species, the llama or guanaco, commonly used as a beast of burthen, and the paco or vicugna, cultivated for its flesh and its wool. Of this opinion was Buffon when he wrote the history of the llama and the paco; but the observation of living specimens of the llama and the vicugna, and the communications of the Abbe Beliardy on the subject, induced him afterwards to admit the latter animal as a third species distinct from both the preceding. In this he was followed by Molina, who, in his Natural History of Chili, separated also the guanaco, and added a fifth species, the Hueque or Chilian sheep of the older authors. Gmelin, Shaw, and almost every subsequent compiler, have adopted these five species without examination, giving to them such synonyms as they could pick up almost indiscriminately from the writers on the natural history of America, and thus creating a mass of confusion which it would be both vain and useless to attempt to unravel.

It seems to be the general opinion among the leading writers of the present day that this subdivision has been carried to too great an extent. M. F. Cuvier limits the number of species to three, the llama and the paco, figured in his work, and the vicugna, a representation of which was given by Buffon in his sixth supplementary volume. In the rejection of Molina's species, the guanaco and the hueque, we think that he is fully justified by the imperfect accounts furnished by that writer, and by his confessed want of materials for completing the history of the animals of which he treats. In the present instance it does not appear that he was personally acquainted with the Peruvian species from which he professed to separate his own. We should indeed have little hesitation in proceeding still further; for we are strongly inclined to agree with Baron Cuvier in regarding the paco as a mere variety of the llama, with the wool more amply developed; and in considering the vicugna as the only animal of the group that deserves to be specifically distinguished from the latter. Our reasons for adopting this opinion it is unnecessary to offer in detail on the present occasion. They are founded partly on the observation of numerous specimens, varying in colour through different shades of white, brown, and black, or a mixture of two of these shades, and having the long woolly hairs developed in various degrees; and partly on our knowledge of the great extent of modification to which the domesticated races of ruminants are uniformly subject.

The first llama that was seen in Europe was landed at Middleburg in 1558, and sent as a present to the emperor. A rude figure of this animal, engraved at Nuremberg, was copied by Gesner in his work on quadrupeds. Several individuals were brought to Spain during the sixteenth and seventeenth centuries; but the first specimen that particularly engaged the attention of European zoologists was that figured by Buffon. It was not again seen in this quarter of the globe until about the commencement of the present century, when a pair, male and female, were sent from Santa Fe de Bogota to St Domingo, and thence transmitted as a present to Josephine, then Madame Bonaparte, at Malmaison. These were represented in the Menagerie du Museum by Marechal, and illustrated by an excellent article from the pen of Baron Cuvier. Marechal's figures are tolerably accurate, and much superior to any former representation, in the works of American travellers or elsewhere, with the exception of that of Frezier, of which we shall have occasion to speak hereafter.

The brown llama in the society's garden appears to be in all respects, except some trifling variations of colour, precisely similar to the specimens figured by Marechal. As in them, the head, neck, and legs of the society's animal are covered with much shorter hair than the rest of the body; a thin short mane extends along the middle of the neck; and the back and sides are thickly

of burden; like that, it is obedient to its driver, and often dies under, but never resists, his cruelty.

Of these animals, some are white, others black, but they are mostly brown; its face resembles that of the camel, and its height is about equal to that of an ass. They are not found in the ancient continent, but entirely belong to the new; nor are they found spread over all America, but are found chiefly upon those mountains that stretch from New Spain to the Straits of Magellan. They inhabit the highest regions of the globe, and seem to require purer air than animals of a lower situation are found to enjoy. Peru seems to be the place where they are found in greatest plenty. In Mexico they are introduced rather as curiosities than beasts of burden; but in Potosi, and other provinces of Peru, they make the chief riches of the Indians and Spaniards who rear them: their flesh is excellent food; their hair or rather wool, may be spun into beautiful clothing; and they are capable, in the most rugged and dangerous ways, of carrying burdens not exceeding a hundred weight, with the greatest safety. It is true,

---

clothed with fine long woolly hairs, becoming smooth, silky, and even shining towards the tips. The general colour, as in the male of Malmaison, is a uniform bright brown; its under parts, and the inside of the limbs, are white; and its head and ears of a deep dusky gray. Its tail is rather short, raised a little from the body, curved downwards, and covered above with long woolly hairs. The legs are moderately thick; the upper lip very prominent and deeply divided; and the neck longer than the fore legs, and consequently bearing a very unusual proportion to the height of the animal. It is remarkably distinguished by its activity and upright bearing, and by the spirited expression of its physiognomy, which is not unmixed with an air of spiteful malice. In temper it is far from docile; it readily accepts of bread or biscuits from the hands of the visitors, but is equally ready to take offence at any supposed injury or insult, and to revenge itself by discharging its saliva upon the offending party. This is the usual expedient to which these animals have recourse when teased or irritated, and it is certainly by no means an agreeable salute, although the mucus thus discharged has none of those corrosive properties which Frezier and other writers have ascribed to it.

In their native state the llamas inhabit the Cordilleras of the Andes, but principally in Peru and Chili. They are rare in Columbia and Paraguay, and seldom make their appearance on the eastern side of the chain. They associate together in herds of one or two hundred individuals, and subsist entirely, according to Frezier, on a peculiar kind of grass or reed called ycho, that covers the mountains on the sides of which they dwell. While they can procure green herbage they are never known to drink, and it may therefore be presumed that they have the power of secreting from their food sufficient liquid to satiate their thirst. They do not appear to be so insensible of cold as the vicugnas, which are generally found at a much greater elevation, and have a much thicker, finer, and closer fleece. At the beginning of the winter, according to Molina, the guanacos (which we believe to be only the wild llamas) abandon the mountains on which they have passed the summer, and descend into the valleys. Here the Chilians hunt them with dogs, which, however, can catch only the younger and less active individuals. The old ones are so swift as scarcely to be run down by an excellent horse, thus offering a striking contrast to the extreme slowness of their motions when in captivity and loaded with heavy baggage. When chased they frequently turn upon their pursuers, neigh with all their might, and then set off again at full speed.

In its native state the llama, or guanaco as it is then termed, is almost uniformly brown; but in domestication it assumes a variety of colours, of which the most usual are black, brown, gray, and white. These colours are frequently mixed in various proportions, or spread in large patches over the body of the animal, which thus becomes mottled or piebald. The unmixed white appears to be the least common; insomuch that a white llama was, according to Father Feuillee, the presiding deity of the natives of the province of Callao, prior to its annexation to the empire of the incas.

At the period of the arrival of the Spaniards in Peru, the llamas were the only ruminants known to the inhabitants, by whom they were employed as beasts of burthen, and were also killed in vast quantities for their flesh and for their fleece. Gregory de Bolivar estimates that in his time four millions were annually killed to be eaten, and no less than three hundred thousand were employed in the transport of the produce of the mines of Potosi alone. The peculiar form of their feet renders them more safe than even mules in ascending and descending the mountain passes, and they consequently remain in use up to the present day for this particular service. But the excellent breed of horses introduced by the Spaniards, which has since multiplied so prodigiously in many parts of South America, has almost entirely superseded their use in the open country; and it is only in some remote districts, where the poverty of the inhabitants precludes them from keeping the more expensive animal, that they are still occasionally employed.

Their chief merit indeed, next to their security of footing, is their sobriety, and the trifling expense at which they may be maintained. "They want," says Father Feuillee, "neither bit nor bridle nor saddle; there is no need of oats to feed them; it is only necessary to unload them in the evening at the place where they are to rest for the night; they go abroad into the country to seek their own food; and in the morning they return to the same place, their baggage is replaced, and they continue their route." Their principal disadvantages are their comparative weakness, the slow rate at which they travel, and the obstinacy of their disposition. They are unable to carry more than from a hundred to a hundred and fifty pounds, at the rate of twelve or fifteen miles a-day; and if their load is too heavy, or the driver has recourse to blows to compel them to proceed faster, they lie down and pertinaciously refuse to proceed. It is customary on this account for each convoy to be followed by a number of spare llamas, to one of which the load is immediately transferred, and the exhausted or obstinate beast is usually sacrificed upon the spot.

The flesh of the llamas is considered savoury when young; and their wool is in great request, especially among the native Indians, who make use of it in the manufacture of stuffs, ropes, bags, and hats. The skin was employed of old by the Peruvians to make soles for shoes; but as they were ignorant of the art of tanning and currying, the shoes thus made were incapable of keeping out the wet. The Spaniards, however, turn it to better account, and convert it into very excellent leather, which is especially valued for the making of harness.—*Gardens and Menageries of the Zoological Society Delineated.* London, 1835, 8vo.

indeed, that they go but slowly, and seldom above fifteen miles a-day; their tread is heavy, but sure; they descend precipices, and find footing among the most craggy rocks, where even men can scarcely accompany them; they are, however, but feeble animals, and after four or five days labour they are obliged to repose for a day or two. They are chiefly used in carrying the riches of the mines of Potosi; and we are told that there are above three hundred thousand of these animals in actual employ.

This animal, as was said before, is above three feet high, and the neck is three feet long, the head is small and well proportioned, the eyes large, the nose long, the lips thick, the upper divided, and the lower a little depending; like all those animals that feed upon grass, it wants the upper cutting teeth; the ears are four inches long, and move with great agility; the tail is but five inches long, it is small, straight, and a little turned up at the end; it is cloven-footed like the ox, but it has a kind of spear-like appendage behind, which assists it in moving over precipices and rugged ways; the wool on the back is short, but long on the sides and the belly; it resembles the camel in the formation of the genital parts in the male, so that it makes urine backwards; it couples also in the same manner, and though it finds much difficulty in the action, it is said to be much inclined to venery. A whole day is often passed before this necessary business can be completed, which is spent in growling, quarreling and spitting at each other; they seldom produce above one at a time, and their age never extends above ten or twelve years at farthest.

Though the llama is no way comparable to the camel, either for size, strength, or perseverance, yet the Americans find a substitute in it, with which they seem perfectly contented. It appears formed for that indolent race of masters which it is obliged to serve; it requires no care, nor no expense in the attending or providing for its sustenance; it is supplied with a warm covering, and therefore does not require to be housed; satisfied with vegetables and grass, it wants neither corn nor hay to subsist on; it is not less moderate in what it drinks, and exceeds even the camel in temperance. Indeed, of all other creatures, it seems to require water least, as it is supplied by nature with saliva in such large quantities, that it spits it out on every occasion: this saliva seems to be the only offensive weapon that the harmless creature has to testify its resentment. When overloaded or fatigued, and driven on by all the torturing acts of its keeper, it falls on its belly, and pours out against him a quantity of this fluid; which, though probably no way hurtful, the Indians are much afraid of. They say, that wherever it falls, it is of such an acrimonious nature that it will either burn the skin, or cause very dangerous eruptions.[1]

Such are these animals in their domestic state; but as they are found wild in very great numbers, they exhibit marks of great force and agility in their state of nature. The stag is scarcely more swift, or the goat or the shamoy a better climber. All its shapes are more delicate and strong; its colour is tawny, and its wool is but short; in their native forests, they are gregarious animals, and are often seen in flocks of two or three hundred at a time. When they perceive a stranger, they regard him at first with astonishment, without marking any fear or surprise; but shortly, as if by common consent, they snuff up the air, somewhat like horses, and at once, by a common flight, take refuge on the tops of the mountains; they are fonder of the northern than the southern side of the Andes; they often climb above the snowy tracts of the mountain, and seem vigorous in proportion to the coldness of their situation. The natives hunt the wild llama for the sake of its fleece. If the dogs surprise one upon the plain, they are generally successful; but if once the llama obtains the rocky precipice of the mountain, the hunters are obliged to desist in their pursuit.

The llama seems to be the largest of the camel kind in America; there are others, which are called GUANACOES and PACOES, that are smaller and weaker, but endued with the same nature, and formed pretty much in the same manner. They seem to bear the same proportions to each other, that the horse does to the ass, and are employed with the same degree of subordination. The wool, however, of the paco, seems to be the most valuable, and it is formed into stuffs not inferior to silk, either in price or beauty. The natural colour of the paco, is that of a dried rose leaf; the manufacturers seldom give its wool any other dye, but form it into quilts and carpets, which exceed those from the Levant. This manufacture forms a very considerable branch of commerce in South America, and probably, too, might be extended to Europe, were the beauty and the durability of what is thus wrought up sufficiently known.

CHAP. VIII.

THE NYL-GHAU.[2]

THIS animal, the name of which is pronounced *nylgaw*, is a native of India, and has but lately been imported into Europe; it seems to be of a middle nature, between the cow and the deer, and carries the appearance of both in its form. In its size, it is as much smaller than the one, as it is larger than the other; its body, horns, and tail, are not unlike those of a bull; and the head, neck, and legs, are very like those of a deer. The colour, in general, is ash or gray, from a mixture of black hairs and white; all along the ridge or edge of the neck, the hair is blacker, larger, and more erect, making a short, thin, and upright mane. Its horns are seven inches long; they are six inches round at the root; growing smaller by degrees, they terminate in a blunt point. The bluntness of these, together with the form of its head and neck, might incline us to suppose it was of the deer kind; but, as it never sheds its horns, it has a greater affinity to the cow.

---

[1] The saliva of llamas, it is now well ascertained, is perfectly harmless.

[2] The Nyl-ghau is a species of antelope, and will be

From the disposition of that brought over to this country, which has been very accurately and minutely described by Dr Hunter, their manners are harmless and gentle. Although in its native wildness it is said to be fierce and vicious, this seemed pleased with every kind of familiarity, and always licked the hand that stroked or gave it bread, and never once attempted to use its horns offensively; it seemed to have much dependence on its organs of smell, and snuffed keenly, and with noise, whenever any person came within sight; it did so likewise when any food or drink was brought to it; and was so easily offended with smells, or so cautious, that it would not taste the bread which was offered, when the hand happened to smell strong of turpentine. Its manner of fighting is very particular. It was observed at Lord Clive's, where two males were put into a little enclosure, that, while they were at a considerable distance from each other, they prepared for the attack, by falling upon their fore-knees, when they shuffled towards each other with a quick pace, keeping still upon their fore-knees; and when they were come within some yards, they made a spring, and darted against each other. The intrepidity and force with which they dart against any object, appeared by the strength with which one of them attempted to overturn a poor labourer, who unthinkingly stood on the outside of the pales of its inclosure. The nyl-ghau, with the quickness of lightning, darted against the woodwork with such violence, that he broke it to pieces, and broke off one of his horns close to the root, which occasioned the animal's death. At all the places in India, where we have settlements, they are considered as rarities, and brought from the distant interior parts of the country. The emperor, sometimes, kills them in such numbers, as to distribute quarters of them to all his omrahs; which shows that they are internally wild and in plenty, and esteemed good and delicious food. The nyl-ghaus which have been brought to England, have been most, if not all of them, received from Surat or Bombay; and they seem to be less uncommon in that part of India, than in Bengal; which gives room for a conjecture, that they may be indigenous perhaps in the province of Guzarat, one of the most western and most considerable of the Hindostan empire, lying to the northward of Surat, and stretching away to the Indian ocean.

---

found described in the notes to the chapter on antelopes. (See page 314.) We, however, retain here the text of our author, being unwilling to disturb the integrity of this edition of Goldsmith by any omission, interpolation, or transposition.

CHAP. IX.

THE BEAR.[1]

Of the Bear there are three different kinds, the brown bear of the Alps, the black bear of North America, which is smaller, and the great Greenland or white bear. These, though different in their forms, are no doubt of the same original, and owe their chief variations to food and climate. They have all the same habitudes, being equally carnivorous, treacherous, and cruel. It has been said, indeed, that the black bear of America rejects animal food; but of the contrary I am certain, as I have often seen the young ones, which are brought over to London, prefer flesh to every kind of vegetable aliment.

The BROWN BEAR is properly an inhabitant of the temperate climates; the black finds subsistence in the northern regions of Europe and America; while the great white bear takes refuge in the most icy climates, and lives where scarcely any other animal can find subsistence.[2]

---

[1] The animals of this kind, including the racoon, wolverene, glutton, and badger, have six front teeth in each jaw; the two lateral ones of the lower jaw are longer than the rest, and lobed, and are likewise furnished with smaller or secondary teeth at their internal bases: the canine teeth are single; there are five or six grinders on each side: the first of which is placed close to the canine teeth: the tongue is smooth: the snout projecting; and the eyes furnished with a nictitant or winking membrane. The soles of the feet are long, and extend to the heel; some use their fore paws as hands, and they are all able, except the grizzly bear, to climb trees in search of prey, or to avoid an enemy.

[2] The brown bear was at one time an inhabitant of Great Britain, as well as of the whole European continent, but has now been completely extirpated from this country, as well as from France, Germany, and Hol-

The brown bear[1] is not only savage, but solitary; he takes refuge in the most unfrequented parts, and the most dangerous precipices, of uninhabited mountains. It chooses its den in the most gloomy parts of the forest, in some cavern that has been hollowed by time, or in the hollow of some old enormous tree. There it retires alone, and passes some months of the winter without provisions, or without ever stirring abroad. However, this animal is not entirely deprived of sensation, like the bat or the dormouse, it seems rather to subsist upon the exuberance of its former flesh, and only feels the calls of appetite, when the fat it had acquired in summer begins to be entirely wasted away. In this manner, when the bear retires to its den, to hide for the winter, it is extremely fat; but at the end of forty or fifty days, when it comes forth to seek for fresh nourishment, it seems to have slept all its flesh away. It is a common report, that during this time they live by sucking their paws, which is a vulgar error that scarcely requires confutation. These solitary animals couple in autumn, but the time of gestation with the female is still unknown:[2] the female takes great care to provide a proper retreat for her young; she secures them in the hollow of a rock, and provides a bed of hay in the warmest part of her den; she brings forth in winter, and the young ones begin to follow her in spring. The male and female by no means inhabit the same den; they have each their separate retreat, and seldom are seen together but upon the accesses of genial desire.[3]

---

land. But in Russia, Bohemia, Poland, and the Alps, it is to be found pretty plentiful, and as far to the east as Japan and Kamschatka.

The usual size of the brown bear is about four feet in length, although they sometimes measure five feet. One which was lately exhibited in the streets of Edinburgh, when walking upright, was nearly six feet in height. The colour is of a dark burnt-umber brown, but nearly black on the legs and feet.

The brown bear is an animal of solitary habits, and continues associated with his mate for a very short time, and then retires to some sequestered cavern, hole in a tree, or pit in the earth.

It is but seldom that the bear will attack man in a wild state, unless provoked by some aggression; but if roused, he proves a formidable and furious enemy. He can climb trees with much ease.

The brown bear lives almost entirely on vegetable food, and it is only when very hungry that he seeks to eat flesh. The whole of this kind are said to be fond of honey; and the natives of Russia, taking advantage of this, form various plans for entrapping them. They fix a heavy log of wood to the trees on which bees have a hive, attached by a long string. The bear climbs the tree in search of the honey, and, finding himself interrupted by the log, he forces it aside, and attempts to pass it; but in returning, it strikes against him with considerable force, and, exciting him, he renews his exertions, till he becomes furious, and continues his obstinate attempts until he is either killed or falls senseless from the tree.

History informs us, that, in early times, bear-baiting was a favourite amusement in England. Sir Thomas Pope entertained Queen Mary and the Princess Elizabeth, at Hatfield, with an exhibition of this barbarous sport, which is said to have afforded them high gratification; and we are told that it was one of the amusements of Kenilworth Castle. Rowland White mentions, that, when Queen Elizabeth was in her sixty-seventh year, she enjoyed the sports of bull and bear-baiting in the tilt-yard. During this and other reigns, there was a special officer appointed for the care of the bears, who had a salary of sixteen pence a-day. It was his duty to provide bears and dogs, and to superintend the sport of baiting; and such was the arbitrary state of the times, that this officer had unlimited powers to send his under-officers to all parts of the kingdom, with authority to seize and carry off bulls, bears, or dogs, for the amusement of his royal master, and for which there was no redress.

We have no public record of this amusement having been sanctioned by royal authority, later than the 11th October, 1561, when a patent was given to Sir Saunders Duncombe, "*for the sole practice and profit of fighting and combating of wild and domestic beasts within the realm of England, for the space of fourteen years.*" These cruel sports were sometimes, although but seldom, practised in England so late as the middle of the eighteenth century. On the continent, however, the sport of bear-baiting is still practised.

[1] Buffon.

[2] The bear is gravid 112 days.

[3] The black bear of America (see Plate XII. fig. 26.) is distinguished from the brown bear of Europe, by few very striking external differences, except the colour of his fur. His forehead has a slight elevation; his muzzle is elongated, and somewhat flattened above; and his hair, though long and straight, has less shagginess than that of most of the other species of the group. In colour it is of a uniform shining jet black, except on the muzzle, where it is short and fawn-coloured, becoming almost gray on the lips and sides of the mouth. This, however, it should be observed, is the character only of the full-grown animal: the young are first of a bright ash colour, which gradually changes to a deep brown, and finally fixes in the glossy black tint of mature age.

The habits and manners of the black bear resemble those of the brown almost as closely as his physical characters. In a state of nature he seeks the recesses of the forest, and passes his solitary life in wild and uncultivated deserts, far from the society of man, and avoiding even that of the animal creation. His usual food consists of the young shoots of vegetables, of their roots, which he digs up with his strong and arcuated claws, and of their fruits, which he obtains by means of the facility with which the same organs enable him to climb the loftiest trees. He possesses indeed the faculty of climbing in a most extraordinary degree, and frequently exercises it in the pursuit of honey, of which he is passionately fond. When all these resources fail him, he will attack the smaller quadrupeds, and sometimes even animals of considerable size; familiarity with danger diminishing his natural

The voice of the bear is a kind of growl, interrupted with rage, which is often capriciously exerted; and though this animal seems gentle and placid to its master, when tamed, yet it is still to be distrusted and managed with caution, as it is often treacherous and resentful without a cause.

This animal is capable of some degree of

---

timidity, and the use of flesh begetting a taste for its continued enjoyment. He is also said like the polar bear, to have a peculiar fondness for fish, and is frequently met with on the borders of lakes and on the coast of the sea, to which he has resorted for the gratification of this appetite. Notwithstanding his apparent clumsiness, he swims with the greatest dexterity, the excessive quantity of fat with which he is loaded serving to buoy him up in the water; in this way he frequently crosses the broadest rivers, or even very considerable arms of the sea.

That portion of North America which still remains uncultivated and desolate, furnishes an abode to this species of bear, which is consequently as widely dispersed as any of his tribe As his fur is of some value in commerce, although not so much sought after at the present day as it was formerly, his race has become an object of the cupidity of man, by whom they are frequently hunted for the sake of their skins. This chase, is principally followed by the Indians, who are also attracted by the flavour of his flesh, of which, and especially of the fat, they partake with an avidity truly disgusting. Travellers, however, who have been reduced to the necessity of having recourse to this sort of food, speak of it as by no means despicable: the fat yields moreover a quantity of oil, which is often extremely serviceable. The Indians will sometimes attack these animals single-handed; and if they can manage to keep beyond the reach of their powerful grasp, which is almost irresistible, are sure of gaining the victory; as the bears, in the rampant posture which they always assume in self-defence, unconsciously expose their most vulnerable parts to the attack of the hunter. Snares are sometimes laid for them; but these are most frequently unsuccessful; that extreme caution, which is so strongly pourtrayed in their actions and demeanour, rendering them mistrustful of every thing. Nevertheless their gluttony will sometimes get the better of their prudence, and the bait of honey offers too tempting an allurement to be always resisted. At other times a whole tribe of Indians will assemble for the chase, and after having performed a variety of superstitious observances, beat the entire country for their game, drive a great number of them into a spot selected for the purpose, and deal forth upon them wholesale destruction. They will also trace them to their retreats in the season of their lethargy, which occupies several of the winter months, and during which the bears are incapable of offering any effectual resistance.

In the Life of Colonel Crockett the backwoodsman, there are some curious anecdotes, of bear-hunting, at which this extraordinary man appears to have been a complete adept. The colonel was residing in 1825, when about thirty-nine years of age, on the Obion River, in the wilder parts of Tennessee, where bears were still to be found in considerable numbers. In the autumn of that year, he had killed and salted as many as were necessary for the support of his family during the winter: "but about this time," says he, in his own narrative, "one of my old neighbours, who had settled down on the lake about twenty-five miles from me, came to my house, and told me he wanted me to go down and kill some bears about in his parts. He said they were extremely fat, and very plenty. I know'd that when they were fat, they were easily taken, for a fat bear cannot run fast or long. But I asked a bear no favours, no way further than civility, for I now had *eight* large dogs, and as fierce as painters [panthers;] so that a bear stood no chance at all to get away from them. So I went home with him, and then went on down towards the Mississippi, and commenced hunting.

"We were out two weeks, and in that time killed fifteen bears. Having now supplied my friend with plenty of meat, I engaged occasionally again with my hands in our boat-building, and getting staves. But I at length couldn't stand it any longer without another hunt. So I concluded to take my little son, and cross over the lake, and take a hunt there. We got over, and that evening turned out and killed three bears, in little or no time. The next morning we drove up four forks, and made a sort of scaffold, on which we salted up our meat, so as to have it out of the reach of the wolves, for as soon as we could leave our camp, they would take possession. We had just ate our breakfast, when a company of hunters came to our camp, who had fourteen dogs, but all so poor, that when they would bark, they would almost have to lean up against a tree and take a rest. I told them their dogs couldn't run in smell of a bear, and they had better stay at my camp, and feed them on the bones I had cut out of my meat. I left them there, and cut out; but I hadn't gone far, when my dogs took a first-rate start after a very large fat old *he-bear*, which ran right plump towards my camp. I pursued on, but my other hunters had heard my dogs coming, and met them, and killed the bear before I got up with him. I gave him to them, and cut out again for a creek called Big Clover, which wa'n't very far off. Just as I got there, and was entering a cane-brake, my dogs all broke and went ahead, and in a little time they raised a fuss in the cane, and seemed to be going every way. I listened a while, and found my dogs were in two companies, and that both were in a snorting fight. I sent my little son to one, and I broke for t'other. I got to mine first, and found my dogs had a two-year-old bear, down a-wooling away on him; so I just took out my big butcher, and went up and slap'd it into him, and killed him without shooting. There were five of the dogs in my company. In a short time I heard my little son fire at his bear; when I went to him, he had killed it too. He had two dogs in his team. Just at this moment we heard my other dog barking a short distance off, and all the rest immediately broke to him. We pushed on too, and when we got there, we found he had still a larger bear than either of them we had killed, tree'd by himself. We killed that one also, which made three we had killed in less than half an hour. We turned in and butchered them, and then started to hunt for water, and a good place to camp. But we had no sooner started, than our dogs took a start after another one, and away they went like a thunder-gust, and were out of hearing in a minute. We followed the way they had gone for some time, but at length we gave up the hope of finding them, and turned back. As we were going back, I came to where a poor fellow was grubbing, and he looked like the very picture of hard times. I asked him what he was doing away there in the woods by himself. He said he was grubbing for a man who intended to settle there; and he did it because he had no meat for his family, and he was working for a little.

"I was mighty sorry for the poor fellow, for it was not only a hard, but a very slow way to get meat for a hungry family; so I told him if he would go with me, I would give him more meat than he could get by grubbing in a month. I intended to supply him with meat, and also to get him to assist my little boy in packing in and salting up my bears. He had never seen a bear instruction. There are few but have seen it dance in awkward measures upon its hind feet, to the voice or the instrument of its leader; and it must be confessed that the dancer is often found to be the best performer of the two. I am told that it is first taught to perform in this manner, by setting it upon hot plates of iron, and then playing to it, while in this uneasy situation.

---

killed in his life. I told him I had six killed then, and my dogs were hard after another. He went off to his little cabin, which was a short distance in the bush, and his wife was very anxious he should go with me. So we started, and went to where I had left my three bears, and made a camp. We then gathered my meat, and salted and scaffolded it, as I had done the other. Night now came on, but no word from my dogs yet. I afterwards found they had tree'd the bear about five miles off, near to a man's house, and had barked at it the whole enduring night. Poor fellows! many a time they looked for me, and wondered why I didn't come, for they know'd there was no mistake in me, and I know'd they were as good as ever fluttered. In the morning, as soon as it was light enough to see, the man took his gun and went to them, and shot the bear, and killed it. My dogs, however, wouldn't have any thing to say to this stranger; so they left him, and came early in the morning back to me.

"We got our breakfast, and cut out again; and we killed four large and very fat bears that day. We hunted out the week, and in that time we killed seventeen, all of them first-rate. When we closed our hunt, I gave the man over a thousand weight of fine fat bear-meat, which pleased him mightily, and made him feel as rich as a Jew. I saw him the next fall, and he told me he had plenty of meat to do him the whole year from his week's hunt.

"When I got home, one of my neighbours was out of meat, and wanted me to go back, and let him go with me, to take another hunt. I could'nt refuse; but I told him that I was afraid the bears had taken to house by that time, for after they get very fat in the fall and early part of the winter, they go into their holes, in large hollow trees, or into hollow logs, or their cane-houses, or the harricanes, and lie there till spring, like frozen snakes. And one thing about this will seem mighty strange to many people. From about the first of January to about the last of April, these varmints lie in their holes altogether. In all that time they have no food to eat; and yet when they come out, they are not an ounce lighter than when they went to house. I don't know the cause of this, but still I know it is a fact; and I leave it for others who have more learning than myself to account for it. They have not a particle of food with them, but they just lie and suck the bottom of their paw all the time. I have killed many of them in their trees, which enables me to speak positively on this subject."

The Grizzly Bear is a native of the northern division of America, and more particularly of that extensive tract of country which constitutes the state of Missouri. It differs in many striking points, both of character and habits, from the black bear, as well as from every other animal of the very natural group of which he forms part By his elongated, narrowed, and flattened muzzle, added to the slight elevation of his forehead, he is closely connected with the black bear of America, and as remarkably distinguished from the common brown bear of Europe, and from the white bear of the polar regions, which last, in size and general form, offers perhaps the nearest approximation to the present species. But his enormous magnitude, which may be stated as averaging twice the bulk of the black bear; the greatly increased size and power of his canine teeth; and, above all, the excessive length of his talons, on the fore feet especially, afford characteristic differences so obvious and so essential, that it is difficult to conceive how they could have been so long overlooked by naturalists as well as travellers, who have all, until within little more than twenty years of the present time, passed him over without even a casual hint that he presented any claims to be considered as distinct from the common species of his country. His hair, generally speaking, is longer, finer, and more abundant than that of the black bear, and varies in colour to an almost indefinite extent, passing through all the intermediate shades between a light gray and a black brown. The brown tinge is, however, the most common; and it is always more or less grizzled either by the intermixture of grayish hairs or by the brown hairs being tipped with gray. His eyes are very small, and hardly at all prominent; and the line of the profile is consequently nearly straight. His tail is scarcely visible, being almost entirely concealed by the long hairs which surround it. The breadth of the fore foot in one of the individuals observed by Captains Lewis and Clarke, exceeded nine inches, while the length of his hind foot, exclusive of the talons, was eleven inches and three quarters, and its breadth seven inches. The claws of the fore foot measure about six inches. The latter are considerably longer and less curved than those of the hind feet, and do not narrow in a lateral direction as they approach their extremity, but diminish only from beneath: the point is consequently formed by the shelving of the inferior surface alone, their breadth remaining the same throughout the whole of their enormous length, and their power being proportionally increased; an admirable provision for enabling the animal to exercise to the fullest extent his propensity for digging up the ground, either in search of food or for other purposes. It appears, however, on the other hand, to unfit him for climbing trees, which he never attempts; and this remarkable circumstance in his habits affords a striking distinction between him and all the other bears, which are essentially climbers.

Of all the quadrupeds which inhabit the northern regions of the American continent, the grizzly bear is unquestionably the most formidable and the most dreaded. Superior to the rest of his tribe, not excepting even the polar species, in bulk, in power, in agility, and in the ferocity of his disposition, it is not to be wondered at that he should be regarded by the native Indians with an almost superstitious terror, and that some portion of this feeling should have been communicated even to the civilized travellers, who have occasionally met with him in the wild and desolate regions which are subject to his devastations.

M. Duvaucel enumerates three species of bears inhabiting India and the neighbouring islands. The first of these is the Ursus Labiatus, which was strangely mistaken on its first arrival in Europe, nearly forty years ago, for a sloth, and received from the naturalists of that day the name of Bradypus pentadactylus, or ursinus, the five-fingered, or Ursine, Sloth; an appellation which has been productive of no little confusion in nomenclature, and is still frequently employed in menageries and exhibitions to distinguish the same animals

The bear, when come to maturity, can never be tamed; it then continues in its native fierceness, and though caged, still formidably impotent, at the approach of its keeper flies to meet him. But notwithstanding the fierceness of this animal, the natives of those countries where it is found, hunt it with great perseverance and alacrity. The least dangerous

---

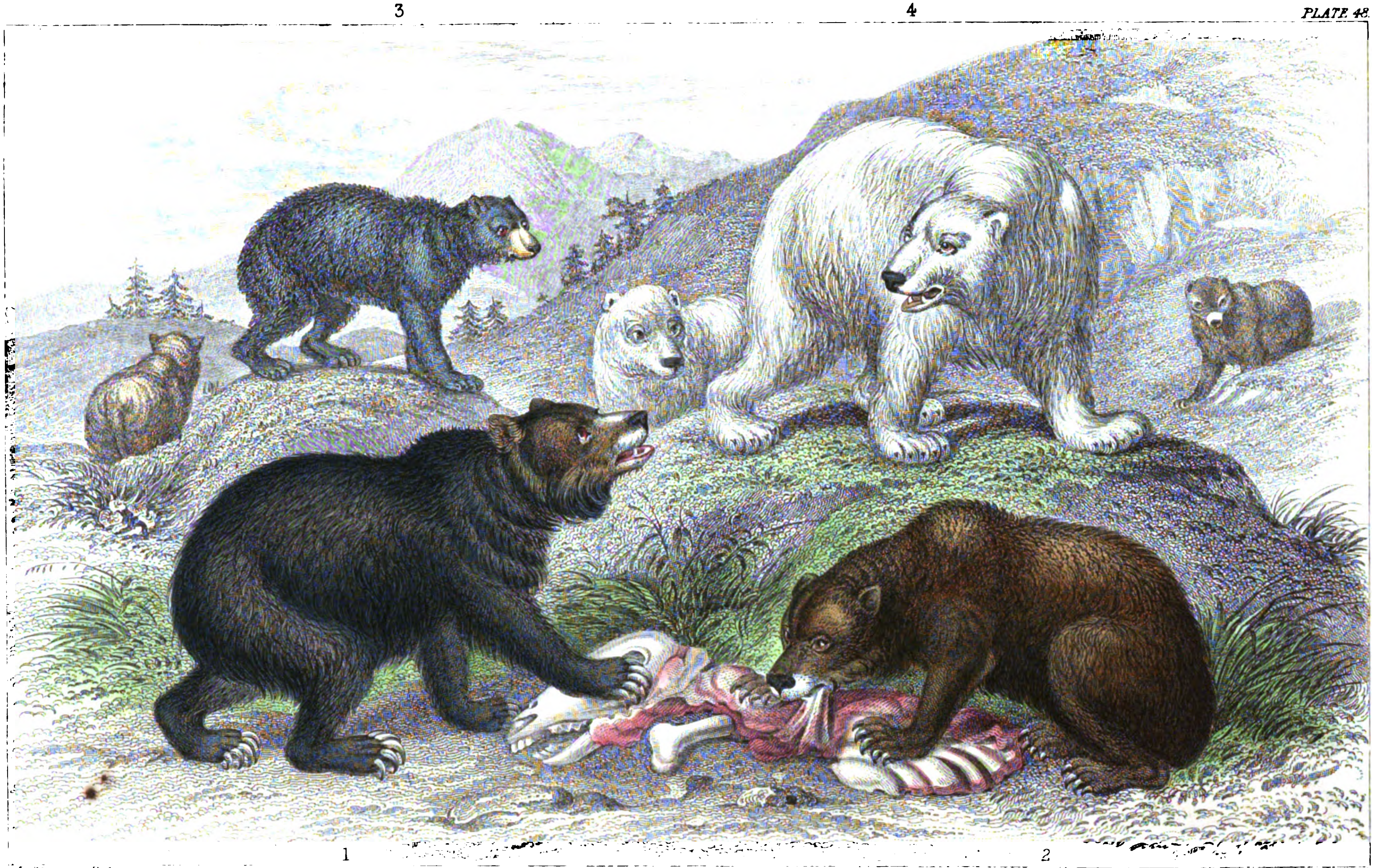
and sometimes even nearly related species. With the true sloths it has nothing in common; and the only circumstance which can at all account for the blunder, consists in the accidental deficiency of the incisor teeth in the animal first examined; a deficiency, which, according to the strict principles of the artificial system then adopted, was alone sufficient to convert a bear into a sloth. The second is the Ursus Malayanus, the Malay bear, admirably illustrated, both with regard to character and habits, by the late lamented Sir Stamford Raffles in the thirteenth volume of the Linnean Transactions. The third is the Thibet bear. Another species connected with the above is the Bornean bear. The Bornean bear is perhaps somewhat shorter in his proportions than the rest of the group, and the great proportional breadth of his head extends also to the neck and body. The claws are very long, strongly arched, and very gradually attenuated to the point, which is transversely truncated and chiefly fitted for digging the earth; but probably also for enabling it to climb with great agility.

Many persons, says the author of Oriental Field Sports, have disputed the existence of the bear in India. Facts, however, impose a silence on all attempts at reasoning on this point, as to its heavy coat of hair, and the heat of the country; for to the great annoyance of the villagers, bears not only exist in India, but do much mischief to the crops, and occasionally devour many of the inhabitants.

The Bengal bear is distinguished by the deep black colour of his hair, and by a crescent of white hair like a gorget on his breast. The hind legs are shorter, and the paws flatter and longer than those of European breed; his pace is more shuffling, awkward, and laboured, though quick enough to overtake a man on foot; and his hair is long, and thinly scattered over his body. He is remarkably active in climbing; frequently when not more than a month old, a cub will ascend to the shoulders of his keeper with great ease, and descend again stern foremost with equal adroitness. They are of a most sanguinary disposition, and will chew and suck at a limb till it be a perfect pulp. They do not bite away the flesh like most beasts of prey, but prefer extracting the blood and juices by suction. While stationed at Dacca, I went with a party several times to the great house at Tergong, distant about five miles from the town. I had on several occasions seen bears among the wild mango tops, and did not consider them as being so dangerous, until one day as I was returning with a friend from hunting some hog-deer, we heard a most lamentable outcry in the cover through which we had to pass. Having our spears, and being provided with guns, we alighted, not doubting but a leopard had attacked some poor woodcutter. We met a woman whose fears had deprived her of speech, and whose senses were just flitting. She, however, collected herself sufficiently to pronounce the word *bauloo*, which signifies a bear. She led us with caution to a spot not more than fifty yards distant, where we found her husband extended on the ground, his hands and feet, as I before observed, sucked and chewed into a perfect pulp, the teguments of the limbs in general drawn from under the skin, and the skull mostly laid bare, the skin of it hanging down in long strips, obviously effected by their talons. What was most singular, was, that the unhappy man retained his senses sufficiently to describe that he had been attacked by several bears—the woman said seven—one of which embraced him while the others clawed him about the head, and bit at his arms and legs, seemingly in competition for the booty. We conveyed the wretched object to the house, where, in a few hours, death relieved him from a state in which no human being could afford the smallest assistance. These merciless brutes dash from the covers, both single and in numbers, to attack passengers. As to escaping into trees, that would be poor evasion; for the bear climbs with astonishing ease.

During our halt in the Himalaya mountains, says a writer in the Oriental Annual, a circumstance occurred which I confess I feel no little pleasure at having the opportunity of recording, as it is highly characteristic of the skill of the mountaineers in baffling the ferocious propensities of those animals by which they are so perpetually threatened with mischief. I had entered a deep dell with my gun, accompanied by two hill-men, in order to try if I could not succeed in killing some jungle-fowl, which are here tolerably abundant, though so wild as to render it a matter of no common difficulty to get near them. After a long and fatiguing walk, we ascended with some toil a very sudden abruption of the mountain, when upon gaining the summit, which overhung a precipice, a bear started from a recess in the neighbouring covert, and advanced evidently with sinister intentions towards us. I was about to fire, though my gun was only loaded with large shot, when one of my highland guides motioned me to desist, giving me to understand, by significant gesticulations (for I understood his language but very indifferently) that he would attack the enemy unarmed; and from the coolness and dexterity with which he commenced operations, I confess I could not persuade myself to doubt of a favourable result, in spite of the difficulties which seemed to defy its accomplishment. Almost upon the extreme edge of the precipice stood a tall tree with strong vertical branches, apparently of the character though not the form of the mountain-ash, being very tough and elastic. The hill-man approached the bear, and by exciting it withdrew its attention from me towards himself. The exasperated beast immediately made him the object of attack, when the man adroitly sprang on the tree, as nimbly followed by the bear. The former having reached the upper branches, he quickly slipped a strong cord over the top of the limb upon which he stood, at the same time dropping the reverse end upon the ground. This was instantly seized by his companion, who, pulling with all his strength, drew the point of the bough downward until the branch projected nearly in a horizontal line from the stem: there were no intervening branches betwixt this and the precipice, the edge of which it nearly overhung when in its natural position. As soon as the bough was warped to the necessary degree of tension, the mountaineer crept cautiously as near the extremity as he could with safety, followed as cautiously by the bear; but, the moment he saw his angry foe upon the bent branch, he dexterously let himself down by the cord to the ground. The bear, thus unexpectedly deprived of its victim, attempted to turn, in order to retrace its steps; no sooner, however, had it relaxed its grasp of the bough for this purpose, than the hill-man suddenly cut the cord, which had been securely tied to the stump of a tree, and the depressed branch instantly gained its original position with an irresistible momentum. The suddenness and vigour of the recoil shook the bear from its hold, elancing it, like the fragment of a rock from a catapult, into the empty air; uttering a stifled yell, it was hurled over the precipice, and, falling with a dull crash upon the rocks beneath, no doubt soon became a prey to the vultures and jackals. The address with which the bold highlander accomplished this dangerous

PLATE 48.



J. Stewart Del.

J. Bishop Sc.

1. GRISLY BEAR. 2. EUROPEAN BROWN BEAR. 3. AMERICAN BLACK BEAR. 4. POLAR BEAR.

Blackie & Son, Glasgow Edinburgh & London.

method of taking it is by intoxicating it, by throwing brandy upon honey, which it seems to be chiefly fond of, and seeks for in the hollow of trees. In Canada, where the **BLACK BEARS** are very common, and where their dens are made in trees that are hollow towards the top, they are taken by setting fire to their retreats, which are often above thirty-feet from the ground. The old one is generally seen first to issue from her den, and is shot by the hunters. The young ones as they descend are caught in a noose, and are either kept, or killed for provision. Their paws are said to be a great delicacy, and their hams are well enough known at the tables of the luxurious here. Their fat also, which still preserves a certain degree of fluidity, is supposed to be an efficacious remedy in white or indolent tumours, though probably very little superior to hog's lard.

The **WHITE GREENLAND BEAR** differs greatly, both in figure and dimensions, from those already described; and though it preserves in general the external form of its more southern kindred, yet it grows to above three times the size. The brown bear is seldom above six feet long; the white bear is often known from twelve to thirteen. The brown bear is made rather strong and sturdy like the mastiff; the Greenland bear, though covered with very long hair, and apparently bulky, is nevertheless more slender, both as to the head, neck, and body, and more inclining to the shape of the greyhound. In short all the variations of its figure, and its colour, seem to proceed from the coldness of the climate where it resides, and the nature of the food it is supplied with.[1]

The white bear seems the only animal, that, by being placed in the coldest climate, grows larger than those that live in the temperate zones. All other species of animated

---

exploit was as astonishing as it was novel.—*Oriental Annual.*

[1] *Polar bear.*—In the arctic regions where the vegetable kingdom is feebly represented by lichens and mosses, but where, on the contrary, the ocean teems with myriads of small mollusca, and at the same time exhibits animal life under its bulkiest forms,—here the polar bear is found laying wait for and combating the walrus and the seal; pursuing and overtaking in its own element the swift salmon; employing stratagem to surprise the smaller quadrupeds and birds which in summer time visit the higher latitudes; less delicate also in his appetites than the more strictly carnivorous quadrupeds, this species does not disdain to feast on the stranded carcass of the whale; and being of a slothful disposition, he prefers this more easy and more abundant sustenance, to that which demands from him more active predatory exertions.

In the tropical regions, on the contrary, where vegetation is exhibited under the most luxuriant forms and in the greatest profusion, the bears live almost exclusively on vegetable matter; and it is interesting to observe that these species are the smallest of the genus, and are consequently best fitted for climbing; whilst the bears inhabiting the wilds of Siberia, the rocky mountains of North America, and the arctic icebergs, attain that superior size and strength which enable them to execute the acts of destruction necessary for their own support and existence.

Besides differences in size and colour, there are few characteristics by which the species can be distinguished from each other; and these marks of distinction are by no means prominent or easily perceived. Linnæus, who had never had an opportunity of examining the polar bear, doubted even its specific difference from the brown bear, which consequently was the only one admitted into his catalogue of species.

This species ranks among the larger productions of the animated creation; but it must be observed that in the accounts of the older navigators its size has been greatly exaggerated. Those seen by the naturalists who accompanied Captain Parry in the northern expeditions, did not in general exceed seven or eight feet in length. Captain Lyon has given the dimensions of one which was considered to be unusually large, being 8 feet 7½ inches long, and weighing 1,600 lbs. A female which was attended by two cubs, was killed on the 31st of August, 1822, and was so small that two or three men were able to lift her into a boat; yet she must have attained the period at which she was capable of propagating her kind on or before the autumn of the preceding year.

In its choice of habitation the polar bear differs most from the rest of the species. Instead of seeking concealment in the depths of forests, it prefers the floating iceberg and the open sea, its powers of swimming peculiarly adapting it to that sphere of existence. It rarely frequents the coasts of the frozen ocean, and does not descend to the eastern boundary of Siberia, nor to Kamtschatka: and although it is met with on the north coast of America and in Hudson's Bay, it does not inhabit the islands between America and Siberia. They resort to Spitzbergen in great numbers, and sometimes are transported on the ice to the coasts of Iceland and Norway; but the inhabitants of these places destroy them as soon as they are detected. The part of Siberia where they are found to be most numerous is at the mouths of the rivers Lena and Janissea.

The sagacity of the polar bear is well known to the whale fishers. They find the greatest difficulty in entrapping him, although he fearlessly approaches their vessels. The following instances of this sagacity are very curious:—

"A seal lying on the middle of a large piece of ice, with a hole just before it, was marked out by a bear for its prey, and secured by the artifice of diving under the ice, and making its way to the hole by which the seal was prepared to retreat. The seal, however, observed its approach, and plunged into the water; but the bear instantly sprung upon it, and appeared, in about a minute afterwards, with the seal in its mouth.

"The captain of one of the whalers being anxious to procure a bear, without wounding the skin, made trial of the stratagem of laying the noose of a rope in the snow, and placing a piece of kreng within it. A bear, ranging the neighbouring ice, was soon enticed to the nature diminish as they approach the poles, and seem contracted in their size by the rigours of the ambient atmosphere; but the bear, being unmolested in these desolate climates, and meeting no animal but what he can easily conquer, finding also a sufficient supply of fishy provisions, grows to an enormous size, and as the lion is the tyrant of an African forest, so the bear remains undisputed master of the icy mountains in Spitzbergen and Greenland. When our mariners land upon those shores, in such parts as have not been frequented before, the white bears come down to view them with an awkward curiosity; they approach slowly, seeming undetermined whether to advance or retreat, and being naturally a timorous animal, they are only urged on by the conscious experience of their former victories; however, when they are shot at, or wounded, they endeavour to fly, or, finding that impracticable, they make a fierce and desperate resistance till they die. As they live upon fish and seals, their flesh is too strong for food, and the captors have nothing but the skin to reward them for the dangers incurred in the engagement.

The number of these animals that are found about the north pole, if we consider the scarcity there of all other terrestrial creatures, is very amazing. They are not only seen at land, but often on ice-floats, several leagues at sea. They are often transported in this manner to the very shores of Iceland, where they no sooner land, but all the natives are in arms to receive them. It often happens, that when a Greenlander and his wife are paddling out at sea, by coming too near an ice-float, a white bear unexpectedly jumps into their boat, and if he does not overset it, sits calmly where he first came down, and, like a passenger, suffers himself to be rowed along. It is probable the poor little Greenlander is not very fond of his new guest; however, he makes a virtue of necessity, and hospitably rows him to shore.

As this animal lives chiefly upon fish, seals, and dead whales, it seldom removes far from the shore. When forced by hunger, it often ventures into the deep, swims after seals, and devours whatever it can seize; it is, however, but a bad swimmer, and is often hunted in this manner by boats till it is fatigued, and at last destroyed. It often happens that a battle ensues between a bear and a morse or a whale; but as the latter are more expert in their own element, they generally prove victorious. However, when the bear can find a young whale, it repays him for the danger he incurs of meeting with the parent.

---

spot, by the smell of burning meat. He perceived the bait, approached, and seized it in his mouth; but his foot, at the same moment, by a jerk of the rope, being entangled in the noose, he pushed it off with the adjoining paw, and deliberately retired. After having eaten the piece he carried away with him, he returned. The noose, with another piece of kreng, being then replaced, he pushed the rope aside, and again walked triumphantly off with the kreng. A third time the noose was laid; but, excited to caution by the evident observation of the bear, the sailors buried the rope beneath the snow, and laid the bait in a deep hole dug in the centre. The bear once more approached, and the sailors were assured of their success. But Bruin, more sagacious than they expected, after snuffling about the place for a few moments, scraped the snow away with his paw, threw the rope aside, and again escaped unhurt with his prize."

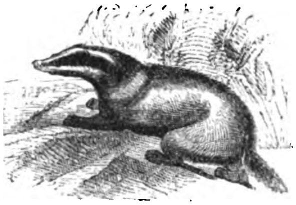
The female polar bear is as fierce in her hostility as the male; but nothing can exceed the affection which she feels for her young. The difficulty of procuring food for them, and the hardships to which they are exposed, no doubt call forth this quality. Some of the instances upon record are as singular as they are affecting. The following is related in one of the Polar Voyages:—

"Early in the morning, the man at the mast-head gave notice that three bears were making their way very fast over the ice, and directing their course towards the ship. They had probably been invited by the blubber of a sea-horse, which the men had set on fire, and which was burning on the ice at the time of their approach. They proved to be a she-bear and her two cubs; but the cubs were nearly as large as the dam. They ran eagerly to the fire, and drew out from the flames part of the flesh of the sea-horse, which remained unconsumed, and ate it voraciously. The crew from the ship threw great pieces of the flesh, which they had still left, upon the ice, which the old bear carried away singly, laid every piece before her cubs, and dividing them, gave each a share, reserving but a small portion to herself. As she was carrying away the last piece, they levelled their muskets at the cubs, and shot them both dead; and in her retreat, they wounded the dam, but not mortally.

"It would have drawn tears of pity from any but unfeeling minds, to have marked the affectionate concern manifested by this poor beast, in the last moments of her expiring young. Though she was sorely wounded, and could but just crawl to the place where they lay, she carried the lump of flesh she had fetched away, as she had done the others before, tore it in pieces, and laid it down before them; and when she saw they refused to eat, she laid her paws first upon one, and then upon the other, and endeavoured to raise them up. All this while it was piteous to hear her moan. When she found she could not stir them, she went off, and when at some distance, looked back and moaned; and that not availing to entice them away, she returned, and smelling around them, began to lick their wounds. She went off a second time, as before, and having crawled a few paces, looked again behind her, and for some time stood moaning. But still her cubs not rising to follow her, she returned to them again, and with signs of inexpressible fondness, went round first one and then the other, pawing them, and moaning. Finding at last that they were cold and lifeless, she raised her head towards the ship, and growled her resentment at the murderers, which they returned with a volley of musket balls. She fell between her cubs, and died licking their wounds."

CHAP. X.

THE BADGER.[1]



The Badger's legs are so short that its belly seems to touch the ground; this, however, is but a deceitful appearance, as it is caused by the length of the hair, which is very long all over the body, and makes it seem much more bulky than it really is. It is a solitary stupid animal, that finds refuge remote from man, and digs itself a deep hole with great assiduity. It seems to avoid the light, and seldom quits its retreat by day, only stealing out at night to find subsistence. It burrows in the ground very easily, its legs being short and strong, and its claws stiff and horny. As it continues to bury itself, it throws the earth behind it to a great distance, and thus forms to itself a winding hole, at the bottom of which it remains in safety. As the fox is not so expert at digging into the earth, it often takes possession of that which has been quitted by the badger; and, some say, forces it from its retreat, by laying its excrement at the mouth of the badger's hole.

This animal, however, is not long in making itself a new habitation, from which it seldom ventures far, as it flies but slowly, and can find safety only in the strength of its retreat. When it is surprised by the dogs at some distance from its hole, it then combats with desperate resolution; it falls upon its back, defends itself on every side, and seldom dies unrevenged in the midst of its enemies.

The badger, like the fox, is a carnivorous animal, and nothing that has life can come amiss to it. It sleeps the greatest part of its time, and thus, without being a voracious feeder, it still keeps fat, particularly in winter. They always keep their hole very clean; and when the female brings forth, she makes a comfortable warm bed of hay, at the bottom of her hole, for the reception of her young. She brings forth in summer, generally to the number of three or four, which she feeds at first with her milk, and afterwards with such petty prey as she can surprise. She seizes the young rabbits in their warren, robs birds' nests, finds out where the wild bees have laid up their honey, and brings all to her expecting brood.

The young ones when taken are easily tamed, but the old still continue savage and incorrigible; the former, after a short time, play with the dogs, follow their master about the house, but seem of all other animals the most fond of the fire. They often approach it so closely, that they even burn themselves in a dangerous manner. They are sometimes also subject to the mange; and have a gland under their tail which scents pretty strongly. The poor of some countries eat their flesh;

---

[1] This animal is furnished by nature with powerful means of defence; it is, however, nevertheless, of a most harmless and inoffensive disposition, and uses these means only when acting on the defensive, as it never attacks any other animal. Its food consists chiefly of roots, fruits, grass, insects, and frogs. It seldom appears abroad during day, but confines itself to its burrow, which it digs to a considerable depth under the ground, and for which purpose it is provided with strong nails.

There is no animal over whom man exercises more savage tyranny than the badger, for whenever one of these poor animals falls into his hands, it is subjected to a life of the most iniquitous torment, being baited by bulldogs and terriers, day after day, until its miserable existence is terminated by being literally torn to pieces. We can only wonder that there still exist men so totally devoid of reflection and humanity as to practice so cruel an amusement; and we are still more astonished that the laws should tolerate it in these enlightened days. Although the Almighty gave man dominion over the beasts of the field, it could never be expected he would exercise such unrelenting cruelty to one of the most harmless of creatures.

The following instance of faithful attachment in the badger was related by a gentleman who resided at the Chateau de Vernours, in France:—

Two persons on a journey, having occasion to pass through a hollow way, accompanied by a dog, he started a badger, and pursued it till it took shelter in a burrow under a tree, and from which it was at length hunted and killed. As they were only a few miles from the village of Chapellatiere, they agreed to drag the badger thither, so that they might receive the reward offered by the commune for every one which was killed, and, besides, to sell its skin to the manufacturer of badger-hair brushes. Having no rope, they twisted some twigs, and drew the animal along the road by turns. They had not proceeded far on their way, when they heard the cry of an animal apparently in distress. They stopped to listen from whence it proceeded, when another badger approached them slowly. They at first threw stones at it, but this did not deter it from approaching its dead companion, which it no sooner reached than it began to lick, and made a mournful cry. The men observing this, desisted from offering it any farther offence, and continued to draw the dead body along as before. The faithful animal continued to follow the dead one, and lying down on it, took it gently by the ear, and in this manner was actually dragged into the village; and even amid the crowd of boys and dogs which were soon collected around, it could not be induced to quit its situation; and, to their shame be it said, they had the inhumanity to kill this affectionate creature, and afterwards burn it, declaring that it could be no other than a witch.

The badger is an inhabitant of Britain, and the whole European continent; and Dr Richardson has identified various new species in his account of animals of the arctic regions.

which though fat is at best but rank and ill-tasted.[1]

CHAP. XI.

THE TAPIR.[2]

(*See Plate XIV. fig.* 16.)

There seems to be a rude, but an inferior resemblance between many animals of the Old and the New World. The cougar of America resembles the tiger in natural ferocity, though far inferior in its dimensions. The llama bears some affinity to the camel, but is far behind it in strength and utility. The tapir may be considered as the hippopotamus of the new continent, but degraded both as to its size and ferocity.

This animal bears some distant resemblance in its form to a mule. It has a long snout, which it lengthens or contracts at pleasure. Its ears are small, long, and pendant. Its neck and tail are short, and its claws strong and firm, of which it has four upon each foot.

---

[1] The spotted badger is of a white colour, marked with reddish, yellow, and dusky spots. It inhabits Europe and the north of Asia, as far as the northern provinces of Persia and China, and in Japan. The white badger is said by Mr Brisson to have been brought from New York; it has very small eyes, and very short legs, and is only one foot nine inches long, with a tail of nine inches. This variety or species, is supposed by Mr Bewick to be the same animal with the land bear. The spotted variety is very rare, nor is it mentioned from what country it was brought.

The American badger (see Plate XII. fig. 30.) inhabits Labrador, and the country about Hudson's Bay, in North America. This animal has a strong resemblance to the common or European badgers, but is somewhat smaller, and the hair is longer, more soft and silky; the ears are short, and of a white colour, edged with black; the head is white, with a black line on each side running from the forehead close to the inner corner of the eye, down to the nose; the hair on the back is four or five inches long, bright brown for the under half, then bright yellow, above that black, and white at the tips: the legs are short, and of a dark brown colour; having five claws behind, and only four before, which are considerably longer and larger; but the want of the fifth claw on the fore part, being described from a dried specimen, may have been owing to accident. Its tail is covered with long dirty yellow hairs, tipped with white, having the ends dusky; the throat, breast, and belly are white; the fore feet have only four toes. It is uncertain whether this animal possesses the orifice under the tail. In each jaw there are six fore teeth, one tusk on each side of each, and four grinders on each side in both; in all thirty-two.

[2] The American tapir is said to reach six feet in length from the extremity of its proboscis to the origin of its diminutive tail; but the largest of our specimens scarcely exceeds five. Its colour is throughout of a deep brown, approaching to black, with the exception of the sides of the lower lip, a band occupying the middle of the chin beneath, the upper edges of the ears, and a naked line at the junction of the hoofs, all which are purely white. The hair is rather scanty all over the body, very short, and so closely pressed to the surface as hardly to be distinguished at a little distance. The skin beneath it is of great density, being, according to M. Roulin, not less than seven lines in thickness on the back, and eight or nine on the cheeks; and so tough that M. Sonini assures us he has frequently fired at a female tapir crossing a river with her young, with his gun heavily loaded, without giving her so much disturbance as to cause her to turn aside from her course, although he could distinctly see the impression of his ball upon her skin. On the back of the neck, extending forwards as far as the level of the eyes, is a thick rounded crest, formed internally of a powerful ligament stretched between the spinous processes of the vertebræ of the neck and a strong elevated ridge occupying the line of junction between the parietal bones of the skull. This singular crest is surmounted by a thin mane of stiff blackish hairs. It is peculiar to the present species, but is not found, according to M. Roulin, in its female at Cayenne: although we have D'Azara's authority for the female being equally furnished with it in Paraguay. In the young female, formerly in the Society's Menagerie, which was brought by Lieutenant Maw from Para in Brazil, it was also very conspicuous. The length of the head is very great and is considerably increased by the prolongation of the muzzle, which is covered with hair of the same colour with that of the rest of the body above, and is naked and flesh-coloured at its flattened extremity and beneath. The eyes are extremely small and of a dull lead-colour.

The young is of a much lighter brown than the adult, with numerous small white spots on the cheeks, a whitish muzzle, and six or eight complete narrow bands of white passing along each side of the body from the shoulders to the haunches. Regular rows of small white spots, placed at equal distances from each other, alternate with these bands. The upper parts of the limbs are marked in a similar manner; their inner sides, as well as the under surface of the body, are white; and their extremities of the ground-colour of the whole body, with a few fainter spots scattered over them. Before the end of the first year of their age this livery becomes completely lost. Similar markings occur in the young of the Sumatran species, and also, we may observe, in that of the hog in its native state. The adult female of the present species has generally a considerable number of whitish hairs intermingled with the brown, which gives her somewhat of a grizzled appearance.

Few animals of equal size have so extensive a range as the American tapir. It is found in every part of South America to the east of the Andes, from the Straits of Magellan to the Isthmus of Darien; but appears to be most common within the tropics. M. Roulin dwells upon it as a singular fact that although it occurs as low as forty degrees to the south of the equator, it ceases suddenly at about 8° north in a situation where it is extremely abundant, and where no adequate cause has yet been assigned to bar its farther progress, no large rivers nor lofty mountains intervening, nor any change in the character of the vegetation of the country being manifest. The left bank of the Atrato near its mouth, and the part of Darien inhabited by the independent Indians, may be considered as its northern limit. Its highest range, in the province of Maraquita at least, appears to be from three thousand to three thousand six hundred feet above the level of the sea, while the new species discovered by M. Roulin is only met with at a much greater elevation.

Throughout this wide extent of country the tapir passes a solitary existence, buried in the depths of the forests and never associating with its fellows; but flying from society and avoiding as much as possible the neigh-its skin is thick, and covered with brown hair; and the natives make shields of it, which cannot be pierced by an arrow.

This animal may, in some measure, be termed amphibious, as it chiefly resides in the water. It differs, however, from all others of this kind, in feeding entirely upon vegetables, and not making this element the place of its

---

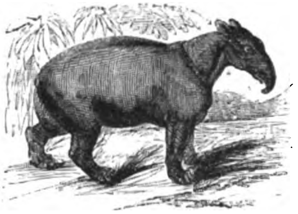
bourhood of man. It rarely stirs abroad from its retreat during the day, which it passes in a state of quiet lethargy; and seeks its food only by night. With the exception of the hog it seems to be the most truly omnivorous of the tribe of animals to which it belongs, for scarcely any thing comes amiss to its ravenous appetite. Its most common food is vegetable, and consists of wild fruits, buds, and shoots. D'Azara tells us that it is also extremely fond of the barrero or nitrous earth of Paraguay. But when pressed by hunger it swallows whatever comes in its way; and the stomachs of those which are killed in their native forests are commonly filled, according to M. Roulin, with pieces of wood, clay, small stones, and sometimes even bones. A specimen kept by D'Azara gnawed in pieces a silver snuff-box and swallowed its contents; and some of those which have been confined in menageries have been known, after a long fast, to devour the worst of all possible filth. In captivity, or when domesticated, it feeds almost indiscriminately on bread, cassava, herbs, roots, fish, and flesh, either raw or cooked; but it still retains its depraved appetite and swallows rags and dirt of all kinds if they are incautiously left within its reach.

The protection afforded by its coat of mail, as its tough skin has been not unaptly termed, together with its great muscular strength, enables the tapir to penetrate through the most densely compacted underwood with little difficulty. Every thing gives way before its efforts, and thus it soon clears itself a path in whatever direction it chooses to proceed. But when once its path is made it seems to prefer the beaten road to the formation of a new one, and goes backwards and forwards in the same track, which the native huntsmen and travellers always select as the easiest passage through the forest. They are, however, cautious not to remain in it during the night, nor to swing their hammocks across it, as in that case they would be liable to receive considerable injury from the shock of the animal as it rushes past in its nocturnal rambles.

The tapir is far, however, from being a mischievous animal. In its natural disposition it is remarkably quiet, and never attacks man or beast except in self-defence or under circumstances of great provocation. It is frequently hunted for its flesh, which, although coarse, dry, and unsavoury to a European palate, is regarded as a great luxury by the native Indians and negroes. Its skin is also highly valued on account of its great thickness and strength. The lasso is seldom employed to take it; for it snaps asunder at a single effort a cord strong enough to interrupt a bull in the height of his headlong course. The most common mode of catching them is to attract them by an imitation of their voice, consisting in a sharp but not very shrill whistle, and thus to bring them so close to the huntsman that his shot rarely fails of its effect. The Indians use poisoned arrows for the same purpose. Another plan, which is also frequently pursued, is for the hunters to station themselves towards evening with their dogs by the side of the tapir's path, to intercept him in his passage to the water, of which, like most animals of his tribe, he is particularly fond, constantly indulging in a bath as soon as he rouses himself for the business of the night, and wallowing at all times in the water with peculiar delight. The dogs are, however, frequently worsted, the tapir defending himself with great courage, seizing his enemies with his teeth, and inflicting on them very severe wounds. When thus attacked he usually endeavours to gain the water, where, standing up to his breast, he defies the largest dogs: his assailants being compelled to swim are unable to bring into action their full agility and strength, while the tapir, quietly watching their motions, seizes them successively as they advance, by the back of their necks, and shakes them off from him with the loss of large portions of their flesh.

It would seem that these animals may be readily tamed, and even to a certain extent domesticated. All those which have been kept in menageries have been perfectly quiet and good tempered; and M. Sonnini assures us that numerous tame individuals are allowed to walk at liberty through the streets of Cayenne, to leave the town, and to go into the neighbouring woods, from which they return in the evening to the house where they are fed. They are fond, he says, of being noticed, recognise their master, follow him about, and give him various tokens of attachment. "It appears to me," adds M. Sonnini, "that with care and attention the tapir might be made serviceable as a beast of burthen of great robustness; its thick-set form and the high degree of strength with which it is endowed, would enable it to bear very heavy loads; and the gentleness of its disposition raises a strong presumption that we should find united in it the two valuable qualities of docility and patience."

Buffon, in laying it down as a general rule that the animals of South America do not exist in the "Old World," pointed particularly to the tapir as a creature eminently peculiar to that continent. The contrary has of late years been proved; for not only have two fossil varieties been disinterred in France, Germany, and Italy, but the animal has actually been found existing in the peninsula of Malacca, and in Sumatra. This variety is represented in the following wood-cut, and may be thus described:—The Malay tapir resembles in form the American, and has a similar flexible proboscis, which is six or eight inches in length. Its general appearance is heavy and massive, somewhat resembling the hog. The eyes are small. The ears are roundish, and bordered with white. The skin is thick and firm, thinly covered with short hair. The legs are short and stout; the fore feet are furnished with four toes, the hind feet with three. In the upper jaw there are seven molar teeth on each side, one small canine inserted exactly on the suture of the incisor bone, and in front six incisors, the two outer of which are elongated into tusks: in the under jaw there are but six molars; the canines are large, and the number of incisors, the outer of which are the smallest, is the same as in the upper jaw.



The first intelligence of the existence of the tapir in Sumatra was given to the government of Fort Marlborough, at Bencoolen, in 1772, by Mr Whalfeldt, who was employed in making a survey of the coast. He considered it to be the hippopotamus, and described it by that name; but the drawing which accompanied the report identifies it with the tapir. After this, the ani-depredations. It feeds upon the pastures by the river-side, and, as it is very timorous, the instant it hears the least noise, it plunges into the stream. They are greatly sought after by the natives, as their flesh is considered as a delicacy, and thought by some not inferior to beef.

CHAP. XII.

THE RACOON.

(*See Plate XII. fig.* 27.)

The Racoon, which some authors have called the Jamaica rat, is about the size of a small badger; its body is short and bulky; its fur is fine, long, and thick, blackish at the surface, and gray towards the bottom; the nose is rather shorter and more pointed than that of the fox; the eyes large and yellow; the teeth resembling those of a dog; the tail thick, but tapering towards a point regularly marked with rings of black, and at least as long as the body; the fore-feet are much shorter than the hinder, both armed with five sharp claws, with which, and his teeth, the animal makes a vigorous resistance. Like the squirrel, it makes use of its paws to hold its food while eating, but it differs from the monkey kind, which uses but one hand on those occasions, whereas the racoon and the squirrel use both; as, wanting the thumb, their paws singly are unfit for grasping or holding. Though this animal be short and bulky, it is however very active; its pointed claws enable it to climb trees with great facility; it runs on the trunk with the same swiftness that it moves upon the plain, and sports among the most extreme branches with great agility, security, and ease; it moves forward chiefly by bounding, and though it proceeds in an oblique direction, it has speed enough most frequently to escape its pursuers.

This animal is a native of the southern parts of America, nor have any travellers mentioned its being found in the ancient continent. But in the climates of which it is a native, it is found in noxious abundance, particularly in Jamaica, where it keeps in the mountains, and where it often descends to feed upon the plantations of sugar-cane. The planters of these climates consider these animals as one of their greatest miseries; they have contrived various methods of destroying them, yet still they propagate in such numbers that neither traps nor fire-arms can set them free; so that a swarm of these famished creatures are found to do more injury in a single night than the labours of a month can repair.

But though, when wild, they are thus troublesome, in a state of tameness no animal is more harmless or amusing; they are capable of being instructed in various little amusing tricks.[1] The racoon is playful and cleanly, and is very easily supported; it eats of every thing that is given it, and, if left to itself, no cat can be a better provider; it examines every corner, eats of all flesh, either boiled or raw, eggs, fruits, or corn; insects themselves cannot escape it, and, if left at liberty in a garden, it will feed upon snails, worms, and beetles; but it has a particular fondness for sweets of every kind, and to be possessed of these in its wild state, it incurs every danger. Though it will eat its provisions dry, it will for choice dip them in water, if it happen to be in the way. It has one peculiarity which few others have been found

---

mal was not noticed for a considerable time. But, in 1805, when Sir Stamford Raffles arrived at Penang, he was informed that, a short time before, in the government of Sir George Leith, the natives had caught an animal which was, in every respect, the model of an elephant, only of a diminutive size. Unfortunately it was brought from Queda to Penang during the governor's absence, and dying before his return, the servants threw its body into the sea. On a subsequent visit made by Sir Stamford Raffles to Malacca, he made particular inquiries as to the new animal, and from the answers he received he felt little doubt that it was not a miniature elephant, but a tapir. Indeed, on showing the natives a drawing of the American tapir they seemed at once to recognise it. The result of later investigations was quite conclusive on this point; and, in 1818, there was in the menagerie at Calcutta a living tapir sent from Bencoolen, and Major Farquhar had, about the same time, sent to the Asiatic society a stuffed specimen and a head, with a paper descriptive of the animal, and giving an account of the discovery. From these an account of the animal, with a drawing, was prepared by M. Diard, and sent to his friends in Paris, where, in March, 1819, M. Fred. Cuvier published it in his great work on the 'Mammalia of the Menageries in Paris.'

[1] In a state of domestication the racoon is very sportive and good tempered, and of a disposition not less inquisitive than the monkey. It examines every object with its paws, which it uses in the manner of hands, to see every thing which is given to it. It is as sly and cunning as a fox, and, like it, is very destructive of poultry. It is said to feed on insects, and opens oysters with astonishing dexterity: it separates the shells, and does not leave a single vestige of the animal within them.

In Brickell's History of North Carolina, we find a record of the wonderful sagacity of this animal. He says it is fond of crabs, and when in search of them takes its station by the side of a swamp, and hanging its tail over into the water, the crabs mistake it for food, and laying hold of it, the racoon soon perceives it pinching, pulls up its tail with a sudden jerk, and lands the crab on the soil, where it suddenly seizes it in its mouth and quickly devours it. He is careful, from experience, which way he seizes the crab, which he does transversely, to prevent the animal from inflicting wounds on his face by his nippers.

to possess—it drinks as well by lapping like the dog as by sucking like the horse.

CHAP. XIII.

THE COATIMONDI.[1]

The first peculiarity with which this animal strikes the spectator is the extreme length of its snout, which, in some measure, resembles that of the hog, but elongated to a surprising degree; it bears some distant resemblance to the animal last described, except that the neck and the body are longer, the fur shorter, and the eyes smaller; but its principal distinction, as was said before, consists in the shape of its nose; the upper jaw being an inch longer than the lower, and the snout, which is movable in every direction, turning up at the end. Like the racoon, it sits upon the hinder legs with great ease, and, in this position, with both paws carries the food to its mouth.

This animal is very subject to eat its own tail, which is rather longer than its body: but this strange appetite is not peculiar to the coati alone; the mococo, and some of the monkey kinds, do the same, and seem to feel no pain in wounding a part of the body so remote from the centre of circulation.

It seems possessed of the same playful qualities, and indiscriminate appetites, with the animal described in the last chapter; if left at liberty in a state of tameness, it will pursue the poultry, and destroy every living thing that it has strength to conquer; though it is playful with its keeper, yet it seems obstinately bent against receiving any instruction, and neither threats nor caresses can induce it to practise any arts to which it is not naturally inclined. When it sleeps, it rolls itself up in a lump, and in that position often continues for fourteen or fifteen hours together.

CHAP. XIV.

THE ANT-BEAR.

There are many animals that live upon ants in Africa and America; the pangolin or scaly lizard of Guinea may be considered among this number; but there are a greater variety in America, which make those minute insects their only subsistence. Though they are of different figures and sizes, yet, in general, they go under one common name of the ant-bear; the peculiar length and slenderness of their snout, their singular appetites, and the manner of taking their prey, striking us too strongly to attend to the minute differences of their size or form.

They have been classed by Mr Buffon into the LARGER TAMANDUA, the SMALLER TAMANDUA, and the ANT-EATER.[2] The longest of this

---

[1] The coatimondi is of the weasel tribe, and is now known by the name of the Brazilian weasel. It is an obstinate and capricious animal. Linnæus had one which he found very troublesome; it killed the poultry, tore off their heads, and sucked the blood. It defended itself with great force, whenever any person attempted to lay hold of it contrary to its inclination; and it stuck fast to the legs of those with whom it was familiar, when it wanted to ransack their pockets, and carry off any thing it found in them. It had an extreme aversion to hog's bristles, and consequently the smallest brush made it desist. Its mode of life was very singular: it slept from midnight to noon, kept awake the rest of the day, and uniformly walked about from six in the evening till midnight, without the least regard to the sort of weather. This is probably the time assigned by nature for procuring its food, which consists chiefly of young birds, eggs, and small animals.

[2] There is some confusion among naturalists in the names bestowed on the different species of ant-eaters. Plate XIV. fig. 6. represents the great ant-eater. Plate XIII. fig. 31. the Cape ant-eater. The following cut represents the ursine ant-eater.

In a communication to the Zoological Society, Sir R. Ker Porter gives a detailed description, accompanied with a drawing, of the *Myrmecophaga jubata*, Linn., under the name of *Orso Hormeguero*, or ant-bear. Sir Robert was particularly struck with the difference in structure which exists between the fore and the hinder feet, and with the curious disposition of the parts of the former in the act of progression, which has been slightly referred to by D'Azara. In the figure (in which the animal is represented in a standing position) the claws of the fore feet do not project in front, but are doubled backwards under the wrist; evidencing a mode of progression in the *Myrmecophaga* similar to that recently described by Col. Sykes as existing in the species of *Manis*. "To receive the additional length and point of the middle toe," observes Sir R. Ker Porter, "a protruding mass of hard flesh stood out from the wrist, wherein was a cavity destined for the reception of the ungulated elongation when the animal was in a standing position." He adds, "from the awkward formation of the fore feet, quickness of motion becomes impossible; hence they may be caught in the smallest open space (when seen) with little difficulty."

Besides the animal here mentioned, there are others of the same kind; the most remarkable of which are the little ant-eater of New Holland and the prickly ant-eater of New Holland. The former is singular for its kind is four feet long, from the tip of the snout to the insertion of the tail; their legs are short, and armed with four strong claws; their tail is long and tufted, and the animal often throws it on its back like the squirrel. The second of this kind is not above eighteen inches long, the tail is without hair, and it sweeps the ground as the animal moves. The **ANT-EATER**, which is the third variety, is still smaller than either of the former, as it is not above seven inches from the tip of the snout to the insertion of the tail. The two former are of a brown dusky colour, but this of a beautiful reddish, mixed with yellow. Though they differ in figure, they all resemble each other in one peculiarity, which is the extreme slenderness of their snout, and the amazing length of their tongue.

The snout is produced in so disproportionate a manner, that the length of it makes near a fourth part of the whole figure. A horse has one of the longest heads of any animal we know, and yet the ant-bear has one above twice as long, in proportion to its body. The snout of this animal is almost round and cylindrical; it is extremely slender, and is scarcely thicker near the eyes than at its extremity. The mouth is very small, the nostrils are very close to each other, the eyes are little in proportion to the length of the nose, the neck is short, the tongue is extremely long, slender, and flatted on both sides; this it keeps generally doubled up in the mouth, and is the only instrument by which it finds subsistence; for the whole of this tribe are entirely without teeth, and find safety only in the remoteness and security of their retreat.

If we examine through the various regions of the earth, we shall find that all the most active, sprightly, and useful quadrupeds have been gathered round man, and either served his pleasures, or still maintained their independence by their vigilance, their cunning, or their industry. It is in the remote solitudes that we are to look for the helpless, the deformed, and the monstrous births of nature. These wretched animals, being incapable of defending themselves either by their agility or their natural arms, fall a prey to every creature that attacks them; they, therefore, retire for safety into the darkest forests, or the more desert mountains, where none of the bolder or swifter animals choose to reside.

It may well be supposed that an animal so helpless as the ant-bear is, with legs too short to fit it for flight, and unprovided with teeth to give it a power of resistance, is neither numerous, nor often seen; its retreats are in the most barren and uncultivated parts of South America. It is a native only of the new continent, and entirely unknown to the old. It lives chiefly in the woods, and hides itself under the fallen leaves. It seldom ventures from its retreat, and the industry of an hour supplies it with sufficient food for several days together. Its manner of procuring its prey is one of the most singular in all natural history: as its name implies, it lives entirely upon ants and insects; these, in the countries where it is bred, are found in the greatest abundance, and often build themselves hills five or six feet high, where they live in community. When this animal approaches an ant-hill, it creeps slowly forward on its belly, taking every precaution to keep itself concealed till it comes within a proper distance of the place where it intends to make its banquet; there, lying closely along at its length, it thrusts forth its round red tongue, which is often two feet long, across the path of these busy insects, and there lets it lie motionless for several minutes together. The ants of that country, some of which are half an inch long, considering it as a piece of flesh accidentally thrown before them, come forth and swarm upon it in great numbers: but where-ever they touch they stick; for this instrument is covered with a slimy fluid, which, like bird-lime, entangles every creature that lights upon it. When, therefore, the ant-bear has found a sufficient number for one morsel, it instantly draws in the tongue, and devours them all in a moment; after which it still continues in its position, practising the same arts until its hunger is entirely appeased; it then retires to its hiding place once more, where it continues in indolent existence till again excited by the calls of hunger.

Such is the luxurious life of a creature that seems, of all others, the most helpless and deformed. It finds safety in its hiding-places from its enemies, and an ample supply in some neighbouring ant-hill for all its appetites. As it only tries to avoid its pursuers it is seldom discovered by them; yet helpless as this animal is, when driven to an extremity. though without teeth, it will fight with its claws with great obstinacy. With these arms alone it has often been found to oppose the dog, and even the jaguar. It throws itself upon its back, fastens upon its enemy with all its claws, sticks with great strength and perseverance, and even after killing its invader, which is sometimes the case, does not quit its

---

having only two toes on the fore feet, armed with strong claws, and a tail which it is able to coil round the branches of trees and hold fast by. The whole animal is clothed in a beautiful, soft, curled, pale yellow fur. It is a native of Guiana. The prickly ant-eater is a short, roundish animal, with a long, tubular mouth, and entirely covered over on the upper parts with strong sharp spines, resembling those of the porcupine.

hold, but remains fastened upon it with vindictive desperation.

CHAP. XV.

THE SLOTH.

Of the Sloth there are two different kinds, distinguished from each other by their claws; the one, which in its native country is called the *unau*, having only two claws upon the fore feet, and being without a tail; the other, which is called the *ai*, having a tail, and three claws upon each foot. (For a representation of the latter, see Plate XIV. fig. 8.) The unau has the snout longer, the ears more apparent, and the fur very different from the other. It differs also in the number of its ribs, this having forty-six, while the ai has but twenty-eight. These differences, however, which, though very apparent, have been but little regarded in the description of two animals which so strongly resemble each other in the general outlines of their figure, in their appetites, and their helpless formation.

They are both, therefore, described under the common appellation of the sloth, and their habitudes well deserve our wonder and curiosity. Nature seems cramped and constrained in their formation; other animals are often indolent from choice, these are slow from necessity: the ai, from which I shall take my description, and from which the other differs only in the slight particulars above-mentioned, and in being rather more active, is of about the size of a badger. Its fur is coarse and staring, somewhat resembling dried grass; the tail very short, and scarce appearing; the mouth extended from ear to ear; the eye dull and heavy; the feet armed with three claws each, and made so short, and set on so awkwardly, that a few paces is often the journey of a week; but though the feet are short, they and still longer than its legs, and these proceed from the body in such an oblique direction, that the sole of the foot seldom touches the ground. When the animal, therefore, is compelled to make a step forward, it scrapes on the back of the nails along the surface, and wheeling the limbs circularly about, yet still touching the ground, it at length places its foot in a progressive position; the other three limbs are all brought about with the same difficulty; and thus it is seen to move, not above three feet in an hour. In fact, this poor creature seldom changes place but by constraint, and when impelled by the severest stings of hunger.[1]

---

[1] The sloth, in its wild condition, spends its whole life on the trees, and never leaves them but through force or accident; and what is more extraordinary, it lives not *upon* the branches, like the squirrel and the monkey, but *under* them. Suspended from the branches it moves, and rests, and sleeps. The arm and fore-arm of the sloth, taken together, are nearly twice the length of the hind-legs; and they are, both by their form and the manner in which they are joined to the body, quite incapacitated from acting in a perpendicular direction, or in supporting it upon the earth, as the bodies of other quadrupeds are supported by their legs. Hence, if the animal be placed on the floor, its belly touches the ground. The wrist and ankle are joined to the fore-arm and leg in an oblique direction; so that it is impossible for it to place the sole of its foot flat down upon a level surface. Besides, the formation of the pelvis alone is of such a nature as to render it impossible for sloths to walk after the manner of ordinary quadrupeds; and the mode in which the limbs are joined to the pelvis seems as if expressly arranged for the purpose of altogether depriving the animal of the ordinary use of its legs. The effect of this conformation is, that the sloth must remain quite stationary when placed on a polished surface; but as the open ground is generally rough, with small protuberances, such as stones, roots of grass, &c., he extends his arms in all directions in search of something to lay hold of; and when he has succeeded, he pulls himself forward, and is thus enabled to trail himself along, but in the exceedingly awkward and tardy manner which has procured him the name of the "sloth." Mr Waterton informs us that he kept a sloth in his room for several months, and often took him out of the house in order to have an opportunity of observing his motions. If the ground were rough, he would pull himself forward in the manner just described, at a pretty good pace; and he invariably directed his course towards the nearest tree. But if he was placed upon a smooth and well-trodden part of the road, he appeared to be in much distress. Within doors, the favourite station of this sloth was on the back of a chair; and, after getting all his legs in a line on the topmost part of it, he would hang there for hours together, and often with a low and plaintive cry would seem to invite the notice of his master.

It should be observed that the sloth does not suspend himself head downward like the vampire,—but, when asleep, he supports himself from a branch parallel to the earth. He first seizes the branch with one arm, and then with the other; after which he brings up both his legs, one by one, to the same branch; so that all the four limbs are in a line. He rests in perfect security in this position, to which his whole structure is adapted. In this attitude the sloth has the power of using the fore paw as a hand in conveying food to his mouth, which he does with great address, retaining meantime a firm hold of the branch with the other three paws. In

The sloth seems to be the meanest and most ill-formed of all those animals that chew the cud; it lives entirely upon vegetable food, on the leaves, the fruit, and the flowers of trees, and often even on the very bark, when nothing else is left on the tree for its subsistence. Like all other ruminant animals, it has four stomachs; and these requiring a large share of provision to supply them, it generally strips a tree of all its verdure in less than a fortnight. Still, however, it keeps aloft, unwilling to descend, while any thing remains that can serve it for food; it therefore falls to devouring the bark, and thus in a short time kills the tree upon which it found its support. Thus destitute of provisions above and crawling slowly from branch to branch in hopes of finding something still left, it is at last obliged to encounter all the dangers that attend it below. Though it is formed by Nature for climbing a tree with great pain and difficulty, yet it is utterly unable to descend; it therefore is obliged to drop from the branches to the ground, and as it is incapable of exerting itself to break the violence of its descent, it drops like a shapeless heavy mass, and feels no small shock in the fall. There, after remaining some time torpid, it prepares for a journey to some neighbouring tree; but this of all migrations is the most tedious, dangerous, and painful; it often takes a week in crawling to a tree not fifty yards distant; it moves with imperceptible slowness, and often baits by the way. All motions seem to torture it, every

---

all his operations, the enormous claws with which the sloth is provided are of indispensable service. They are so sharp and crooked that they readily seize upon the smallest inequalities in the bark of the trees and branches among which the animal habitually resides, and, united to the great muscular strength and rigid formation of the extremities, furnish very powerful weapons of defence.

All our readers are aware of the story that the sloth entirely confines himself to one tree, until he has completely stripped it of its leaves. But as in the remote tropical forests which the animal inhabits, the trees touch each other in the greatest profusion, there is manifestly no reason why it should do this, since even the indolence with which it is so unjustly reproached would, in many cases, be more indulged by removing rather to an adjoining tree than to another part of that in which it actually is. Mr Waterton says,—"During the many years I have ranged the forests, I have never seen a tree in such a state of nudity; indeed I would hazard a conjecture, that, by the time the animal had finished the last of the old leaves there would be a new crop on the part of the tree he had stripped first, ready for him to begin again, so quick is the process of vegetation in these countries." The same entertaining writer thus describes the travels of the sloth. "There is a saying among the Indians, that when the wind blows the sloth begins to travel. In calm weather he remains tranquil, probably not liking to cling to the brittle extremity of the branches, lest they should break with him in passing from one tree to another; but as soon as the wind rises, the branches of the neighbouring trees become interwoven, and then the sloth seizes hold of them and pursues his journey in safety. There is seldom an entire day of calm in these forests. The trade wind generally sets in about ten o'clock in the morning. The sloth then travels at a good round pace; and were you to see him pass from tree to tree, as I have done, you would never think of calling him a sloth." In fact, the animal is distinguished among the Europeans settled in America by the name of ai, from a plaintive feeble cry, resembling that word, which it emits while in motion.

The sloth brings forth and suckles its young like ordinary quadrupeds. The young sloth, from the moment of its birth, clings to the body of its parent until it gains sufficient size and strength to shift for itself. Only a single young one is produced at a birth. Sloths are exceedingly tenacious of life. They have been seen to move their legs, and exhibit other symptoms of vivacity, a full half hour after having been deprived of the heart and other viscera. Waterton states that he saw the heart of one beat for half an hour after it was taken out of the body, and adds, that the wourali poison seems to be the only thing that will kill it quickly. An arrow dipped in it will kill a sloth in about ten minutes. It is a scarce and solitary animal, found only in the most gloomy and retired tropical forests of South America. Its flesh is much relished by the Indians, who are therefore in continual pursuit of it.

The common sloth has a short round head, furnished with coarse shaggy hair, disposed on the crown in verging rays, like that of the human species. The face is of a yellowish colour, covered with very short hair, whilst that of the body and extremities is universally long and shaggy. The eyes are encircled by a brown ring. The hair of the body is varied with irregular patches of dark and light, brown or silvery white. Between the shoulders there is an oval patch of short orange-coloured hair, of a finer quality than that which is found on other parts of the body, and divided in the centre by a longitudinal black stripe: the throat and breast are frequently of a light straw colour. The texture of the hair is very peculiar, and has a nearer resemblance to dry hay, or grass shrivelled and withered by the sun, than to the hair of ordinary quadrupeds. It is coarse and flattened at the extremity, but near the root it is as small as the finest spider's web; and its dry and withered appearance forms the animal's principal security against its pursuers, as it renders it exceedingly difficult to be detected while at rest among the branches, covered with bark and moss of the same colour. It is only when in motion that it can be readily distinguished from the branch beneath which it hangs suspended. In other respects, different individuals of the species differ considerably from one another in the shades and disposition of their colours, and in the intensity of the mark between the shoulders; some are even altogether destitute of this last mark, others are of a uniform ash-colour over the whole body, and there are others still which have the hair of the head parted in the centre and hanging down upon each side. It is not, however, exactly determined whether these constitute distinct species, or are merely varieties of the common sloth. The known species have nothing more than the rudiment of a tail. Their dental system is exceedingly simple: they have no incisor teeth, but canines and molars only; the former diminutive, and very similar to the latter. The molar teeth are eight in the upper jaw and six in the lower;—four and three on either side respectively. It is very remarkable also that sloths, although their necks are so short, have nine vertebræ, whereas most other quadrupeds, even those with the longest necks, have but seven. Thus it will be seen that, altogether, there is scarcely a member of the animal kingdom more remarkably constituted, or more deserving of being carefully studied.—*Penny Magazine.*

step it takes it sets forth a most plaintive, melancholy cry, which from some distant similitude to the human voice, excites a kind of disgust, mixed with pity. This plaintive sound seems its chief defence, few quadrupeds appear willing to interrupt its progress, either that the flesh is offensive, or that they are terrified at its cries. When at length they reach their destined tree, they mount it with much greater ease than when they moved upon the plain. They fall to with famished appetite, and, as before, destroy the very source that supplies them.

How far these may be considered as the unfinished productions of nature, I will not take upon me to determine; if we measure their happiness by our sensations, nothing, it is certain, can be more miserable; but it is probable, considered with regard to themselves, they may have some stores of comfort unknown to us, which may set them upon a level with some other inferior ranks of the creation; if a part of their life be exposed to pain and labour, it is compensated by a larger portion of plenty, indolence, and safety. In fact, they are formed very differently from all other quadrupeds, and, it is probable, they have different enjoyments. Like birds, they have but one common vent for the purposes of propagation, excrement, and urine. Like the tortoise, which they resemble in the slowness of their motion, they continue to live some time after their nobler parts are wounded, or even taken away. They bear the marks of all those homely-formed animals, that, like rude machines, are not easily discomposed.

Its note,[1] according to Kircher, is an ascending and descending hexachord, which it utters only by night; its look is so piteous, as to move compassion; it is also accompanied with tears, that dissuade everybody from injuring so wretched a being. Its abstinence from food is remarkably powerful; one that had fastened itself by its feet to a pole, and was so suspended across two beams, remained forty days, without meat, drink, or sleep; the strength of its feet is so great, that whatsoever it seizes on cannot possibly be freed from its claws. A dog was let loose at the above-mentioned animal, taken from the pole; after some time the sloth laid hold of the dog with its feet, and held him four days, till he perished with hunger.[2]

CHAP. XVI.

THE JERBOA.[3]

This animal as little resembles a quadruped, as that which has been described in a former chapter. If we should suppose a bird, divested of its feathers, and walking upon its legs, it might give us some idea of its figure. It has fore feet indeed, but in running, or resting, it never makes use of any but the hinder. The number of legs, however, do not much contribute to any animal's speed; and the jerboa, though, properly speaking, furnished but with two, is one of the swiftest creatures in the world.

The jerboa is not above the size of a large rat, and its head is sloped somewhat in the manner of a rabbit; the teeth also are formed like those of the rat kind, there being two cutting teeth in each jaw; it has a very long tail, tufted at the end; the head, the back, and sides, are covered with long ash-coloured soft hair; the breast and belly are whitish; but what most deserves our attention in the formation of this little animal, is the legs; the fore-legs are not an inch long, with four claws and a thumb upon each, while the hinder legs are two inches and a quarter, and exactly resemble those of a bird, there being but three toes, the middlemost of which is longest.

The jerboa is found in Egypt, Barbary, Palestine, and the deserts between Bassora and Aleppo; its hind-legs, as was said before, are only used in running, while the fore-paws, like those of a squirrel, grasp its food, and in some measure perform the office of hands. It is often seen by travellers as they pass along the deserts, crossing their way, and jumping six or eight feet at every bound, and going so swiftly, that scarce any other quadruped is able to overtake them. They are a lively, harmless race of animals, living entirely upon vegetables, and burrowing like rabbits in the ground. Mr Pennant tells us of two that were lately brought to London, that burrowed almost through the brick wall of the room where they were kept; they came out of their hole at night for food, and when caught were much fatter and sleeker than when confined to their burrows. A variety of this animal is found also in Siberia and Circassia, and is, most probably, common enough over all Asia. They are more expert diggers than even the rabbit itself; and when pursued for a long time, if they cannot escape by their swiftness, they try to make a hole instantly in the ground, in which they often bury themselves deep enough to find security before their pursuers come up. Their burrows, in some places, are so thick, as to be dangerous to travellers, the horses perpetually falling in them. It is a provident little animal, and lays up for the winter. It cuts grass in heaps of a foot square, which, when dried, it carries into its burrow, therewith to serve it for food, or to keep its young warm during the rigours of the winter.

---

[1] Pennant's Synopsis.

[2] In addition to the two here mentioned, another, and by far the largest of its kind, has lately been introduced to the notice of naturalists from India. This animal approaches in size and shape to that of the common bear, being clothed with a very long black shaggy hair. Its snout is a little elongated, and appears as if cut off at the end. The feet are all armed with five crooked pointed claws; and the tail is short, and hardly visible. In its motions, it was not, as in the others, slow and languid; but it appeared moderately lively, and gave a kind of short abrupt roar when disturbed or irritated. It fed principally upon vegetables and milk, and was much delighted with honey and sweet things. It was said to burrow, and to have been dug out of its subterraneous retreat when first discovered.

[3] The jerboa will be found described in the note to p. 455, among the class of animals to which it belongs. We, however, as in the case of the Nyl-Ghau, retain the text of Goldsmith.

But of all animals of this kind, that which was first discovered and described by Mr Banks, is the most extraordinary. He calls it the *kangaroo;* and though from its general outline, and the most striking peculiarities of its figure, it greatly resembles the jerboa, yet it entirely differs, if we consider its size, or those minute distinctions which direct the makers of systems in assorting the general ranks of nature.

The largest of the jerboa kind which are to be found in the ancient continent, do not exceed the size of a rabbit. The kangaroo of New Holland, where it is only to be found, is often known to weigh above sixty pounds, and must consequently be as large as a sheep.[1] Although the skin of that which was stuffed and brought home by Mr Banks, was not much above the size of a hare, yet it was greatly superior to any of the jerboa kind that have been hitherto known, and very different in many particulars. The snout of the jerboa, as has been said, is short and round, that of the discovered animal long and slender; the teeth also entirely differ; for as the jerboa has but two cutting teeth in each jaw, making four in all, this animal, besides its cutting

---

[1] Kangaroos were among the first fruits which accrued to natural history from the discovery of New South Wales, a country which has since proved fertile in new and remarkable forms both of the animal and vegetable creations. Their natural habits in a wild state are still, however, very imperfectly known. They appear to live in small herds, perhaps single families, which are said to submit to the guidance of the older males, and to inhabit in preference the neighbourhood of woods and thickets. They are, as might be inferred from the small size of their mouths and the peculiar character of their teeth, purely herbivorous, feeding chiefly upon grass and roots. Their flesh is eaten by the colonists, by whom it is said to be nutritious and savoury, an assertion which is confirmed by those who have partaken of it in England. In order to procure this they are frequently hunted in their native country; but the dogs who are employed in this service sometimes meet with dangerous wounds, not only from the blows of their powerful tail, which is their usual weapon of defence, but also from the claws of their hind feet, with which they have been known to lacerate the bodies of their assailants in a shocking manner. But, unless when thus driven to make use of such powers of self-defence as they possess, they are perfectly harmless and even timid; and, when domesticated, are not in the least mischievous. In several collections in this country, they have become almost naturalized, and appear to be but little affected by the change of climate. When confined in a small inclosure, they uniformly make their path round its circuit, seldom crossing it or passing in any other direction except for the purpose of procuring their food. Their whole appearance, and especially their mode of progression, is singularly curious, and even to a certain extent ludicrous.

Since the preceding paragraph was written, the several species of the Kangaroo have been more attentively studied, and their differences more clearly defined. We have figured a number of species in our coloured Plate XLIV, and here annex a few particulars regarding each.

LORD DERBY'S KANGAROO (*Macropus Derbianus*). This animal, in size and general proportions, resembles the Eugene Island Kangaroo, but the tail is considerably longer. It inhabits the Swan River. Length twenty-two inches to insertion of the tail, and the tail itself seventeen inches. Pl. XLIV. fig. 1.

ARÖE KANGAROO (*Macropus ualabatus*), inhabits New South Wales. Length to insertion of tail about thirty inches, and the tail itself twenty-four inches. Pl. XLIV. fig 2.

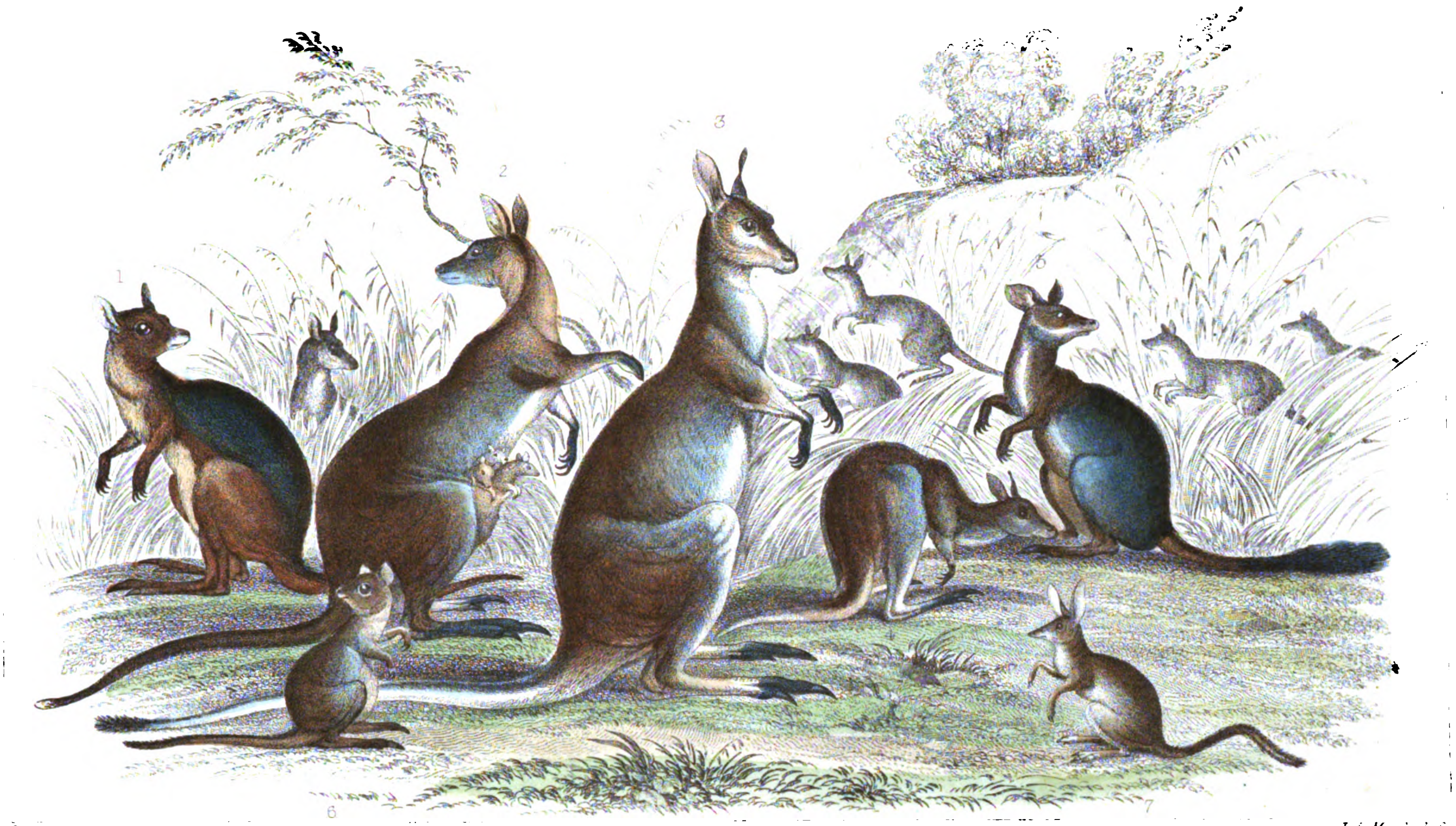
PARRY'S KANGAROO (*Macropus Parryi*). Length to insertion of tail thirty-four inches, and tail thirty-one inches An individual of this species was brought from New South Wales by Captain Parry, who states that it was obtained at Stroud, near Port Stepheus, in the latitude of about 30° South. It was caught by the natives, by whom it is called *Wollaroo,* and was thrown out of its mother's pouch when the latter was hunted. When taken it was less than a rabbit, but acquired its full growth in about two and a half years Whilst in New South Wales, it ran about the house and grounds like a dog; it expressed its anger, when irritated, by a discordant sound, a sort of half-grunting, half-hissing. This species seems to inhabit no part of the colony in the latitude of Sidney. Pl. XLIV. fig. 8.

WOOLLY KANGAROO (*Macropus laniger*). Length from nose to root of tail, when full-grown, five feet; and tail three feet. It is remarkable for its short woolly, or rather cotton-like fur. Pl. XLIV. fig. 4.

BRUSH-TAILED KANGAROO (*Macropus penicillatus*). This species is known by the several names of Rock Kangaroo, Brush-tailed Kangaroo, and Mountain Kangaroo. Captain Parry has remarked that they appear to be gregarious, and seem to prefer the neighbourhood of rocky ground. Of one specimen of this species, presented to the Zoological Society, in 1836, it was observed that it was remarkably fond of leaping upon a narrow ledge or shelf, placed about three feet from the ground, on which it would sit and balance itself for some little time, and return soon to leap back again. Probably the memory of this animal carried it back to its native locality, and unrestrained liberty, and this exercise was an endeavour to realise its former gambols, when leaping from ledge to ledge of its native rocks. Length twenty-five inches, exclusive of tail, which last measures twenty-two inches. Pl. XLIV. fig. 5.

RAT-TAILED HYPSIPRYMNUS (*Hypsiprymnus murinus*). This species inhabits New South Wales, where it appears to be common. Length to insertion of tail fifteen inches, and tail about eleven inches. The Hypsiprymni or Kangaroo Rats have the general characteristics of the Kangaroo tribe. Pl. XLIV. fig. 6.

RABBIT-EARED PERAMELES (*Perameles lagotes*). Found in the neighbourhood of the Swan River. About the size of a rabbit. Pl. XLIV. fig. 7.



J. Stewart Del.

J. S. Murdoch Sc.

1. LORD DERBY'S KANGAROO. 2. AROE KANGAROO 3. PARRY'S KANGAROO 4. WOOLLY KANGAROO.
5. BRUSH TAILED KANGAROO. 6. RAT-TAILED HYPSIPRYMNUS 7. RABBIT-EARED PERAMELES.

Blackie & Son, Glasgow, Edinburgh & London

teeth, has four canine teeth also; but what makes a more striking peculiarity, is the formation of its lower jaw, which, as the ingenious discoverer supposes, is divided into two parts, which open and shut like a pair of scissors, and cut grass, probably this animal's principal food. The head, neck, and shoulders are very small in proportion to the other parts of the body; the tail is nearly as long as the body, thick near the rump, and tapering towards the head and ears, which bear a slight resemblance to those of the hare. We are not told, however, from the formation of its stomach, to what class of quadrupeds it belongs; from its eating grass, which it has been seen to do, one would be apt to rank it among the ruminating animals; but from the canine teeth which it is found to have, we may on the other hand suppose it to bear some relation to the carnivorous. Upon the whole, however, it can be classed with none more properly than with animals of the jerboa kind, as its hind legs are so much longer than the fore; it moves also precisely in the same manner, taking great bounds of ten or twelve feet at a time, and thus sometimes escaping even the fleetest greyhound with which Mr Banks pursued it. One of them that was killed proved to be good food; but a second, which weighed eighty-four pounds, and was not yet come to its full growth, was found to be much inferior.[1]

With this last described and last discovered animal, I shall conclude the history of quadrupeds, which of all parts of natural knowledge seems to have been described the most accurately. As these, from their figure, as

---

[1] The Marsupialia, or pouched animals, as regards the conformation of their generative system, are organized in accordance with a type intermediate between that common to birds, and that which characterizes mammalia, properly so called. The marsupial quadrupeds bring forth their young alive, but in such an imperfect condition, that at the period of their birth scarcely the vestiges of their limbs have become apparent. In this state they are conveyed into a pouch formed by the skin of the abdomen of the female, where they fix themselves by their mouths to the nipples of their mother, and, sucking milk, derive from this source the materials of their growth. These animals are peculiar to America and Australia, and it is remarkable that in the latter country all the quadrupeds, with one or two exceptions, and these probably imported, are constructed on the marsupial type. The skeleton of the marsupial mammifer is distinguished by the presence of two peculiar bones attached to the anterior margin of the pubis, and which in the living animal are imbedded in the muscular walls of the abdomen, and thus support the pouch of the female. The same bones, however, exist also in the male; and even in the Monotremata, which are allied to the marsupials, similar bones are found in the same position, although the females of this class of animals possess no pouch. The class of marsupials comprises numerous families, of various forms and habits. The opossums (Didelphis) of the American continent live in trees, feeding on birds, insects, and fruits; others are terrestrial in their habits. Species of Didelphis are dispersed through the United States, California, Mexico, Peru, Guyana, Brazil (where the number of distinct species is no less than twenty-two), Paraguay, Banda Oriental, and Chili; the entire number being fifty-two, of which only one species, namely, *D. virginiana*, belongs to the States. The species of Australian marsupials are greatly more numerous, being distributed throughout South, North, and Western Australia, Van Diemen's Land, and New South Wales. It is interesting to observe that the fossil remains of marsupial animals of extinct species have been discovered not only in Australia, but in Britain and France, both in the secondary and tertiary formations, showing, as Dr Buckland remarks, that this order of animals, so far from being of more recent introduction than other orders of mammalia, is in reality the first and most ancient condition under which animals of this class appeared upon our planet; that, as far as we know, it was their only form during the secondary period; that it was co-existent with many other orders in the early parts of the tertiary period; and that its geographical distribution in the present creation is limited to North and South America, and to Australia, with the adjacent islands.

The Virginian Opossum is about the size of a domestic cat, of a dull white colour, with a brownish circle round each eye, and a tail shorter than the length of the body. It is an arboreal animal, having the thumb of the hind foot opposable to the other fingers, and thus adapted for grasping the boughs. Although it preys chiefly upon birds, insects, and fruits, it also occasionally indulges a carnivorous appetite, for which purpose it makes incursions into the farm-yard. A quaint writer says:—"The possum is found nowhere but in America. She is the wonder of all the land animals, being the size of a badger, and near that colour. The female doubtless breeds her young at her teats, for I have seen them stick fast thereto when they have been no bigger than a small raspberry, and seemingly inanimate. She has a paunch or false belly, wherein she carries her young after they are from those teats, till they can shift for themselves. Their food is roots, poultry, or wild fruits. They have no hair on their tails, but a sort of scale or hard crust, as the beavers have. If a cat has nine lives, this creature surely has nineteen, for if you break every bone in their skin, and mash their skull, leaving them for dead, you may come an hour after, and they will be gone quite away, or perhaps you may meet them creeping away. They are a very stupid creature, utterly neglecting their safety. I have, for necessity in the wilderness, eaten of them. Their flesh is very white and well tasted, but their ugly tails put me out of conceit with that fare. They climb trees as the racoons do." Not only is the tail of use to the adult animal as a prehensile organ, but it is stated that the little ones, when advanced in growth, leap upon their mother's back if they are frightened, and, twisting their tails round hers, escape with her assistance the apprehended danger. In captivity the animal is sullen, snarling, and stupid. Professor Owen notices that those marsupial quadrupeds which he had an opportunity of examining alive in the Zoological Gardens of London, were all characterized by a low degree of intelligence, nor could he learn that they ever manifested any sign of recognition of their keepers or feeders. Another character no less uniformly belonging to them is their want of a power of uttering vocalized sounds. They emit a wheezing or snarling guttural sound when irritated; the ursine opossum, an Australian species, even uttered a kind of growl or hollow bark. The Wombat (Phascolomys), of New South Wales, emits a loud hiss when irritated, resembling that of a serpent. A beautiful provision is met with in the construction of the respiratory passages of the well as their sagacity, bear the nearest resemblance to man, and from their uses or enmities are the most respectable parts of the inferior creation; so it was his interest and his pleasure to make himself acquainted with their history. It is probable therefore that time, which enlarges the sphere of our knowledge in other parts of learning, can add but very little to this. The addition of a new quadruped to the catalogue already known, is of no small consequence, and happens but seldom; for the number of all is so few, that

---

young marsupial, intended to prevent the possibility of suffocation consequent upon the admission of milk into the windpipe, a circumstance that, without some peculiar arrangement, might readily happen. The new-born kangaroo possesses greater powers of action than the same sized embryo of a sheep (says Owen), and approximates more nearly in this respect to the new-born of the rat, yet it is evidently inferior to the latter, for although it is enabled by the muscular power of its lips to grasp and adhere firmly to the nipple, it seems to be unable therefrom to draw sustenance by its own unaided efforts. The mother, as Professor Geoffrey and Mr Morgan have shown, is therefore provided with a peculiar adaptation of a muscle to the mammary gland, for the evident purpose of injecting the milk from the nipple into the mouth of the adherent young. Now, unless the act of suction on the part of the fœtus corresponds to the maternal act of injection, the little creature would inevitably be suffocated from milk being forced into the trachea. But such an accident is effectually obviated by a peculiar arrangement, whereby the air-passage is completely separated from the fauces, and the injected milk flows in a divided stream, on either side of the larynx, into the œsophagus. "Thus aided and protected by modifications of structure, both in the system of the mother and its own, designed with especial reference to each other's condition, and affording therefore the most irrefragable evidence of creative foresight, the feeble offspring continues to increase from sustenance exclusively derived from the mother, for a period of about eight months." The young kangaroo is then seen protruding its head from the pouch of the mother, and cropping the grass. Ultimately it quits the pouch, and hops about with a feeble and vacillating gait, occasionally seeking the shelter of the pouch, and sucking the teats of the mother, till it has attained the weight of ten pounds. After this, it will occasionally insert its head for the purpose of sucking, even although another fœtus has been transferred to the pouch, for the latter, by a curious instinct, attaches itself to a different nipple from the one previously in use.

The Kangaroo Rat, or Potoroo (Hypsiprimnus), is remarkable for the disproportionate length of its hind legs; these, however, are destitute of a thumb, and the two innermost toes are joined together as far as the nails, so that there appear to be but three toes, the inner one being furnished with two claws. Legs so constructed are well adapted for making vigorous leaps along the level plain. The manners of the animal are mild and timid; it lives on vegetable food, and is said to burrow in the ground. It is common in the neighbourhood of Port Jackson, especially near the river Weragambia, in the Blue mountains. The Hare Kangaroo (*Macropus leporoides*), is a pretty little kangaroo of the size of a common hare. It leaps with extraordinary agility. On the plains in South Australia, Gould started one before a couple of fleet dogs; after running a quarter of a mile, it suddenly doubled and came back upon him, followed by the dogs. "I stood perfectly still," he says, "and the animal had arrived within twenty feet before it observed me, when to my astonishment, instead of branching off to the right or the left, it bounded clear over my head, and on descending to the ground, I was enabled to make a successful shot." Another species, named the Agile Kangaroo (*Macropus agilis*), inhabits the north coast of Australia, and is able to elude the dogs sent in pursuit of it by its extreme activity in leaping over the high crags. Le Brun's Kangaroo (*Macropus Brunii*), is a native of New Guinea, and is interesting as having been the first of the marsupials with which naturalists were made acquainted, having been described by Le Brun as early as 1711. It has a very long narrow head, and strong fore-legs; a specimen is in the British Museum, obtained by an expedition recently sent out by the Dutch government. The wombat (Phascolomys of Geoffrey, *Didelphys ursina* of Shaw), is the only species known of the genus to which it belongs. It inhabits the islands on the coast of New South Wales; a specimen brought from thence lived in the London Zoological Society's collection for five years. The animal is described as being squat, thick, and short-legged, rather inactive, although with the appearance of stumpy strength, and somewhat bigger than a turnspit dog. Its length from the tip of the tail to the tip of the nose is thirty-one inches, of which its body takes up twenty-three inches, the head seven inches; weight about five and twenty or thirty pounds. The animal is not remarkable for swiftness, as most men could run it down; its gait is shuffling and ungainly, somewhat like that of the bear; it is a grass eater, and of gentle disposition, but bites hard, and is furious when irritated. It is then only that its voice is heard, emitting a sound between hissing and whizzing. Mr Bass chased one, and with his hands under his belly, suddenly lifted him off the ground without hurting him, and laid him on his back along his arm. The animal made no noise, and did not even struggle to escape. He carried the beast upwards of a mile, and its countenance was calm and placid, till having occasion to secure the legs while he went into the bush, the creature was irritated by the pinching of the twine, and whizzing with all its might, it kicked and scratched with fury, snapping off a piece of Mr Bass's jacket with its teeth. The animal continued implacable all the way to the boat, only ceasing its struggles when it became exhausted. The wombat inhabits Furneaux's island, and the mountains to the westward of Port Jackson, where it burrows underground. It fed chiefly on grass, and was sometimes seen industriously turning over the dry ricks of sea-weed thrown up on the shore. The digestive organs present a development corresponding generally to that characterizing the same parts in the plant-eating rodents. The flesh of the wombat is described as being delicate, and it is said that the animal, with a little care, might be naturalized in this country. Various species of the kangaroo have been kept in the public parks and menageries of England, becoming almost acclimatized. They were fed upon green vegetables, hay, oats, bran, and bread, and became extremely tame and good-tempered, and not in the least mischievous. Mr Bennet observed that when confined in a small inclosure, they generally follow its circuit, seldom crossing it, or passing in any other direction, except for the purpose of procuring food. A female, which had been kept, and suffered to roam at large in the Royal Park at Windsor, was placed in the Tower menagerie, where it once produced young. One writer records, in an early volume of the *Penny Magazine*, that he had a tame kangaroo which lapped tea out of a saucer, and "picked a bone like a monkey." A remarkably fine pair was some years since kept in Exeter 'Change. The male would sometimes wrestle with his keeper for the space of ten or fifteen minutes, during which he evinced the utmost fearlessness and sagacity, turning in every direction to face his opponent, and watching the opportunity to close with him, occawherever a new one is found, it becomes an object worthy our best attention. It may take refuge in its native deserts from our pursuits, but not from our curiosity.

But it is very different with the inferior ranks of the creation; the classes of birds, of fishes, and of insects, are all much more numerous, and more incompletely known. The quadruped is possessed of no arts of escaping, which we are not able to overcome; but the bird removes itself by its swiftness, the fishes find protection in their native element, and

---

sionally grasping him with his fore-paws, and kicking him with the right hind leg. The contest occasionally became obstinate, and the keeper acknowledged that the kangaroo was almost his superior in strength.

Professor Owen has described the fœtus of a specimen of the greater kangaroo, at apparently the middle period of uterine gestation, which in this animal lasts thirty-eight days. The membranes consisted of an amnios, a large vitelline sac, and a thin unvascular chorion. *There was no placenta*, nor any adhesion between the exterior membrane of the fœtus and the internal surface of the mother, by the opposition and interlacement of villi, or vessels, as in those mammals in which the placenta is replaced by a uniform villous and vascular chorion; the condition of the fœtus was, in short, such as obtains in the viper and other ovoviviparous reptiles. The young, according to the same accurate observer, does not exceed, on the day of its birth, one inch two lines from the nose to the end of the tail; its eyes are closed, and its integuments are of the colour and semi-transparency of an earth-worm. The most singular and instructive of the phenomena connected with the natural economy of marsupial animals is this premature production of the young, which are brought forth in a scarcely organized form, containing, like the chrysalis, the mere germ of the future animal, before its senses are perfected or its members developed. As yet, however, we have no certain knowledge of the manner in which the young animal is deposited in the pouch of the mother, how it becomes attached to the nipple inside, or of the nature and circumstances of its subsequent development. Owen made careful observations of a specimen in the vivarium of the Zoological Society in 1833, before it gave birth to a young one, but as parturition took place in the night, the act of transmission to the pouch was unfortunately not observed. When examined twelve hours after this process had taken place, the little one was found adhering firmly to the point of the nipple, breathing slowly but strongly, and moving its fore-legs when disturbed. Its body was bent upon the abdomen, its short tail tucked in between the hind legs, but with the three divisions of the toes now distinct. The length and general aspect of the animal were as above described. The fœtus was removed from the nipple, and deposited in the bottom of the pouch, with the view of enabling the observer to ascertain the nature of the connection, and whether the little creature would voluntarily endeavour to recover its place. This, however, it made no effort to accomplish, and the mother meanwhile evinced symptoms of uneasiness; at length she grasped the sides of the orifice of the pouch with her fore-paws, and drawing them apart, as if in the act of opening a bag, she thrust her head into the cavity as far as the eyes, and could be seen moving it about in different directions. After repeating this act about a dozen times, she lay down and seemed to be at ease. It was inferred from the actions of the mother during this investigation, that the young animal is conveyed to the pouch by means of the mouth alone, the fore-paws being only employed to open the entrance of the marsupium. This view corresponds with the habits of other quadrupeds, as dogs, cats, and mice, which always use the mouth in conveying their helpless offspring. It has been conclusively established by repeated dissections both of kangaroos and opossums, that there is no internal passage or communication between the uterus and the marsupium, so that the transference of the young to the pouch at the moment of its birth is undoubtedly an external act. It was also shown by the experiment that the young does not by any of its motions justify the idea that it instinctively creeps up to the nipple. After the mother had rested for half an hour, the pouch was again examined, when the fœtus was found within two inches of the nipple, still breathing strongly. The observer attempted to replace it on the nipple, but did not succeed. When the pouch was sometime afterwards examined, the fœtus had disappeared, having probably been destroyed by the mother, owing to the disturbance of the young one. Other instances have occurred in which the young has been detached and successfully replaced on the nipple. Mr Collie mentions, indeed, that the young has been repeatedly seen with its mouth free from the nipple, and afterwards regaining its hold of the teat, and vigorously employed in sucking. Owen concludes from various observations made on the subject, that the fact is established of the mammary fœtus being able at a very early age to sustain a separation from the nipple; and although at this period it may not possess the power of regaining the connection by its own unaided efforts, it is far from being the inert and formless creature it has been described to be, resembling, on the contrary, in its vital powers, the new-born young of the smaller mammalia, rather than the uterine fœtus of a larger species at a period of development when such a fœtus corresponds in size to a new-born kangaroo; and although the latter possesses greater powers of action than the same sized embryo of a sheep, and approximates more nearly in this respect to the new-born young of the rat, yet Owen observes that it is evidently inferior to the latter. For, though enabled by the muscular power of its lips to grasp and adhere firmly to the nipple, its own unaided efforts seem incapable of drawing sustenance therefrom.

It is only necessary to add, in order to distinguish the marsupial from the higher classes of mammiferous animals, that the latter do not produce their young until they have attained a considerably advanced stage of development during their uterine existence; and that the connection between the maternal and fœtal systems in these orders is maintained, during the latter periods of gestation, by the development of a peculiar viscus, named the *placenta*. After birth, the young animals are equally dependent, with the marsupial or *non-placental* mammalia, upon the milk supplied by the appropriate organs in the mother.

Marsupial animals are divided into two great groups, the *Marsupialia* proper, containing the kangaroos and opossums, and the *Monotremata*, containing the Ornithorhynchus and Echidna. Before we are in a condition to make the transition from birds to quadrupeds, we must retrace our steps, and consider the structure of the Monotremata, a group of animals which, notwithstanding their quadrupedal form and hairy covering, are so nearly allied to the feathered ovipara in many points of their organization, that they evidently form a connecting link between these two great classes of animals. These animals possess mammary glands, and must therefore be supposed to give suck to their offspring, although it is not yet satisfactorily determined whether they lay eggs or produce living young. The structure of their reproductive system seems to be allied to that of oviparous rather than of the mammiferous type; and as in birds, the rectum, urinary passages, and sexual organs all discharge themselves into a common cloacal insects are secured in their minuteness, numbers, and variety. Of all these, therefore, we have but a very inadequate catalogue; and though the list be already very large, yet every hour is adding to its extent.

In fact, all knowledge is pleasant only as the object of it contributes to render man happy; and the services of quadrupeds being so very necessary to him in every situation, he is particularly interested in their history: without their aid, what a wretched and forlorn creature would he have been! the prin-

---

chamber, so that there is still but a single vent, a peculiarity from whence the name of the organ is derived. The *Ornithorhynchus paradoxus* or *O. platypus* of Australia, or as it is commonly named the Water-mole by the colonists, and the Mullingong by the natives, is the only species. Its skeleton, in many respects, presents a close resemblance to that of a bird. The mouth resembles the bill of a duck. It possesses a distinct furcular bone in addition to what would appear to be the ordinary clavicles, although these are in reality the coracoid bones still largely developed. The anterior sternal ribs are ossified like those of a bird, and a spur is attached to the hind foot of the male, having some resemblance to that of a cock. This appendage is perforated by a duct, and has a gland connected with it, situated on the inner side of the thigh, by which a poisonous secretion was at one time supposed to be secreted. Its hind feet are broadly webbed, the animal being essentially of aquatic habits. The animal well deserves the specific name applied to it by naturalists. It is alike paradoxical in its structure and its functions. "Having the beak of a bird, how is the creature to suck?" asks Professor Jones. "Nevertheless," he adds, "the females have mammary glands well developed, but destitute of prominent nipples, so that the mode in which the young animal obtains the milk provided for it is even yet a puzzling question. Does the ornithorhynchus lay eggs or produce living young ones? This is a query that has not been satisfactorily answered; and its generative apparatus is so nearly related to that of an oviparous animal, that even anatomy throws but little light upon the subject."

The total length of the adult ornithorhynchus is about one foot six or seven inches; the body is long, reminding one not only in shape but in colour of the otter. It is covered with a double coat of fur, like aquatic mammalia in general: the outer vest consists of long, fine glossy hair, thickly set, which in some individuals assumes a crisped appearance; beneath this, close to the skin, is a layer of short soft fur, forming an almost water-proof wadding. The tail, which is broad and flattened, terminates abruptly, and is covered above with longer and coarser hairs than those of the body; the under surface of the tail, however, is almost destitute of covering—at least the hairs are short and thinly set.

The most remarkable part of the skeleton is perhaps the shoulder, which answers to that of birds, and still more to that of certain lizards. The external surface of the scapula is concave, so that it is far from adapting itself to the ribs. The whole sternal apparatus appears to be formed more after the model of the saurians than that of the mammals; indeed it very much resembles that of the ichthyosaurus, and, like it, is admirably adapted to the condition of an animal destined to dive to the bottom of lakes and rivers for food or safety, and requiring the means of rising rapidly to the surface for fresh supplies of air. The neck has seven cervical vertebræ, like the rest of mammals. The limbs are remarkable for their strength and shortness; the anterior pair especially are very muscular, and the feet well adapted for burrowing, notwithstanding their being largely webbed. The toes are five in number, and terminate in strong blunt claws, capable of scratching the earth with great facility; the web which intervenes between the toes is of a tough leathery consistence, and from its extending beyond the claws might seem to be an impediment in the way of these instruments being fairly and effectually used. It would appear, however, that being loose it falls back (being perhaps voluntarily retained so), while the creature is engaged in its laborious task of burrowing, so as not to interfere with the due application of the claws. The advantage of this broad web in an aquatic animal, or one that spends so great a portion of its existence in the water, is very apparent. The hind feet are smaller than the anterior, but also webbed, though the membrane does not extend beyond the roots of the claws, which are sharp and longer than those of the fore-feet. On the hind leg of the male there is, as has already been stated, a strong sharp spur, the use of which does not appear to be very easy of explanation. It is certainly not used as a weapon of offence, nor are the scratches made by it, during the struggles of the animal, on the hands of those who endeavour to hold it, attended with the slightest ill consequence. Formerly this spur was supposed to be a poisoned weapon, by which dangerous, if not fatal wounds were inflicted. This is most certainly not the case. It appears that the mistake arose from the misapplication of English words or expressions by the aborigines.

The most singular part of the ornithorhynchus, however, is the head, at least, as regards the external configuration of the animal. Instead of terminating in a snout, as in other mammalia, it is continued into a *beak* resembling that of a *duck*, being broad, compressed, and rounded at the lip; the mandibles of which this beak consists are covered with a cartilaginous or leathery membrane—the outside of the upper mandible being grayish black—the palate flesh-colour; the under mandible is flesh-colour within, and whitish externally. The edges of both are soft, and the lower, which is shorter and narrower than the upper, has its sides internally channelled with grooves like those of a duck, but larger and wider apart. At the base of the beak a loose leathery flap projects from each mandible, and may perhaps form a protection to the eyes while the animal is engaged in searching for food with the beak plunged deep in the mud. True teeth there are none; there are, however, in each mandible, on either side, two horny appendages without roots, one tuberculous, and at the base of the mandible fairly within the mouth, the other forming a long narrow ridge on the mandible itself. The tongue is short and thick, and covered with *papillæ*. The eyes are small but bright, and the orifice of the ears is capable of being closed or opened at pleasure. The flesh of this strange animal, though rank and fishy, is eaten by the aborigines, to whom nothing indeed is unacceptable. The question, whether the ornithorhynchus is *viviparous*, or *oviparous*, was long unsettled. For five and twenty years naturalists in Europe had been striving to obtain the carcass of the impregnated female *Ornithorhynchus paradoxus*, for the purpose of ascertaining its mode of gestation, but withcipal part of his food, his clothing, and his amusements, are derived wholly from them; and he may be considered as a great lord, sometimes cherishing his humble dependants, and sometimes terrifying the refractory, to contribute to his delight and conveniences.

The horse and the ass, the elephant, the camel, the lama, and reindeer, contribute to ease his fatigues, and to give him that swiftness which he wants from nature. By their assistance he changes place without labour; he attains health without weariness; his

---

out success; for it is by dissection alone that the hitherto doubtful and disputed point concerning the anomalous and paradoxical manner of bringing forth and rearing its young, could be satisfactorily demonstrated. This long sought for desideratum was at length attained. Through the kindness of Lieutenant the Honourable Lauderdale Maule, of the 39th regiment, Dr Weatherhead had the bodies of several ornithorhynchi transmitted to him from New Holland.

These were submitted for examination to Professor Owen, and, without going into the particulars of his dissections, the following are some points fitted to throw light upon the structure and habits of the animal. The stomach of the larger specimen, one of two young taken with the mother from their nest, was found full of coagulated milk. From the body of the mother, which had been accidentally killed on the fourteenth day after her captivity, milk also exuded in the process of skinning. The other circumstances particularly worthy of notice in these young animals are the total absence of hair, the soft and flexible condition of the mandibles, and the shortness of these parts in proportion to their breadth as compared with the adult form. In the adult the tongue is lodged far back in the mouth, whereas in the young it is advanced close to the end of the lower mandible, and its breadth is only one line less in an individual four inches in length, than it is in the fully grown animal—a disproportionate development which is plainly indicative, as Professor Owen remarks, of the importance of the organ to the young ornithorhynchus, both in receiving and swallowing its food. Various anatomical reasons are given by Professor Owen in support of his belief that the young of the animal are produced alive; but the point is by no means established. He found the ova in the animal to consist of the usual parts, viz. the cortical membrane, the albumen, and the yolk, and that the eggs contained in the uterine cavities had no connection with the walls of the uterus; but he considered the ovum to be deficient in those parts of its organization which appear to be essential to successful incubation, viz. a voluminous yolk to support the germinal membrane, and the mechanism for bringing the cicatricula into contiguity with the body of the parent. But it is suggested by Jones that, if from the reasons adduced by Owen it is allowable to conjecture that the ornithorhynchus is ovo-viviparous, using that term in a strictly philosophical sense, the difficulties of the case are not removed. Granting that the contents of the ovum are barely sufficient to nourish the embryo during the very earliest stages of its development, how is the fœtus matured after the exhaustion of this supply? "There is no reason whatever to suppose that a placenta exists at any period of uterine gestation, neither is there a marsupial pouch in which the prematurely born young can be carried about and supplied with milk; so that whether the young monotreme be developed in the uterus, or out of the uterus, we are equally at a loss to understand how its nutrition is provided for." The force of this difficulty is little diminished by the discovery of milk in the stomach of a young individual; the presence of the lacteal secretion showed that, at that period, the animal derived its sustenance from the breast of the mother, but it does not appear how it was supported during its previous fœtal condition. From these and various other considerations, which it would be out of place to enumerate, the question of the oviparous or viviparous nature of the generation of this strange creature would appear incapable of being decided in the present state of our knowledge.

The caution of the ornithorhynchus, conjoined with the acuteness of its senses, renders it a difficult mark for the sportsman, nor, except it be severely hit about the head, is it easily killed. If only wounded, it dives, and endeavours to make for its burrow, or rises amidst the dense herbage which luxuriates in such localities. When the animal is watched, playfully sporting on the water, the slightest noise or movement is the signal for its disappearance; nor, even when undisturbed, does it remain many minutes without diving: the moment of its reappearance (the gun being levelled in the interim) is the only time for the sportsman. Mr G. Bennet informs us that "these animals are seen in the Australian rivers at all seasons of the year; but a question may arise, whether they do not, in some degree, *hybernate*, for they are more abundant during the summer than in the winter months. When going down, they allow themselves to be carried along by the force of the stream, without making any exertion of their own, but, when swimming against the stream, all their muscular power is exerted to the utmost to stem the force of the current, and it is generally done effectively. I recollect, however, seeing two making repeated and ineffectual attempts to pass a small waterfall during a rapid current of the river, and, after many persevering efforts, they were unable to attain their object." The habits of these animals have been detailed by no one so fully and satisfactorily as by the writer above referred to. He procured, indeed, with considerable trouble, several living specimens, at different times, with a hope of being able to bring them to England—a hope which was always frustrated. On one occasion, having opened a burrow to the extent of upwards of ten feet (its course still continuing up the bank), he captured one of these creatures, which, disturbed from its repose, had ventured to leave its nest at the extremity of the burrow, in order to reconnoitre the cause of the tumult. "When," says Mr Bennet, "I held the unfortunate *platypus* (ornithorhynchus) in my hands, its bright little eyes glistened, and the orifices of its ears were expanded and contracted alternately, as if eager to catch the slightest sound, while its heart palpitated violently with fear and anxiety." It soon, however, became more reconciled to its situation, and "was placed in a cask with grass, mud taken from the river, and water, and everything that could make it comfortable under existing circumstances." At first it endeavoured by scratching to get out, but soon became tranquil, contracted itself into a small compass, and sank to sleep. In the night it was again restless, but was asleep in the morning, "the tail being turned inwards, the head and beak under the breast, and the body contracted into very small compass." This seemed its usual position during sleep, sometimes, however, the beak protruded. When disturbed, it uttered a low, soft growl, not unlike that of a puppy: this noise also accompanied its exertions to escape.

The burrow from which this individual was taken "ran up the bank in a serpentine course, approaching nearer the surface of the earth towards its termination, at which part the nest is situated. This is sufficiently large to accommodate the old animal and its young. No nest had yet been made in the termination of this burrow, for that appears to be formed about the time of bringing forth the young, and consists merely of dried grass, weeds, &c., strewed over the floor of this part of pride is enlarged by the elegance of equipage, and other animals are pursued with a certainty of success. It were happy indeed for man, if, while converting these quadrupeds to his own benefit, he had not turned them to the destruction of his fellow-creatures; he has employed some of them for the purposes of war, and they have conformed to his noxious ambition with but too fatal an obedience.

The cow, the sheep, the deer, and all their varieties, are necessary to him, though in a different manner. Their flesh makes the principal luxuries of his table, and their wool or skins the chief ornament of his person. Even those nations that are forbid to touch anything that has life, cannot wholly dispense with their assistance. The milk of these animals makes a principal part of the food of every country, and often repairs those constitutions that have been broken by disease or intemperance.

The dog, the cat, and the ferret may be considered as having deserted from their fellow quadrupeds, to list themselves under the conduct and protection of man. At his command they exert all their services against such animals as they are capable of destroying, and follow them into places where he himself wants abilities to pursue.

As there is thus a numerous tribe, that he has taken into protection, and that supplies his necessities and amusements, so there is also a still more numerous one, that wages an equal combat against him, and thus calls forth his courage and his industry. Were it not for the lion, the tiger, the panther, the rhinoceros, and the bear, he would scarcely know his own powers, and the superiority of human art over brutal fierce-

---

the habitation. The whole extent of the burrow, from the entrance to the termination, I found by actual admeasurement to be twenty feet." Yet no heaps of earth near the burrow were observed by Mr Bennet, nor does he know, as he says, "how, in the progress of excavation, the animal disposes of the loose mould;" perhaps it carries it to a distance, he goes on to observe, like the mason-wasp and carpenter-bee.

Arriving at Lansdowne Park, Mr Bennet observes, "here I availed myself of the vicinity of some ponds (also inhabited by these animals), to give it a little recreation. On opening the box it was lying in a corner contracted into a very small compass, and fast asleep. I tied a very long cord to its hind leg, and roused it, in return for which I received numerous growls. When placed on the bank it soon found the way into the water, and travelled up the stream, apparently delighting in those places which most abounded in aquatic weeds. Although it would dive in deep water, it appeared to prefer keeping close to the bank, occasionally thrusting its beak (with a motion similar to that of a duck when it feeds) among the mud, and at the roots of the various weeds lining the margin of the ponds, and which we may readily suppose to be the resort of insects. After it had wandered some distance up the chain of ponds, feeding about the shallow water and mud near the banks, it crawled up the bank, enjoyed the luxury of scratching itself and rolling about. In this process of cleaning itself, the hind claws were alone brought into use for the operation, first the claws of one hind leg, then those of the other. The body being so capable of contraction was readily brought within reach of the hind feet, and the head also was brought so close as to have its share in the universal cleaning process. The animal remained for more than an hour cleaning itself, after which it had a more sleek and glossy appearance than before." This individual never became very familiar, and always manifested the greatest reluctance to be placed in its box, from which it escaped one night, and was not again to be discovered. December appears to be the month in which the females bring forth their young; this fact was asserted by the natives, and confirmed by the experience of Mr Bennet, who procured from a burrow on the banks of the Murrumbidgee river, on the 8th of that month, three young ones, one inch and seven-eights in length, nearly naked, and which could not have long been born.

On the 28th of December, Mr Bennet visited a noble sheet of water, called Koroa, formed by the Wollondilly river, on the banks of which the burrow of an ornithorhynchus was discovered. In opening it, "the aborigines used their hard-pointed sticks, and although the ground was firm, they succeeded as quickly as we could have done with our spades." The method of laying open the burrow was by making holes upon it, four or five feet apart, a stick being passed up the burrow as the work proceeded, in order to ascertain its direction. From this burrow he procured two full-furred young ones, a male and female, beautifully sleek and delicate, most probably having never left the burrow. They lived in captivity about five weeks, their liveliness, their frolics, and gambols affording a constant source of interest. "One evening both the animals came out about dusk, went as usual and ate food from the saucer, and then commenced playing with one another like two puppies, attacking with their mandibles, and raising the fore-paws against each other. In the struggle one would get thrust down, and, at the moment when the spectator would expect it to rise again and renew the combat, it would commence scratching itself, its antagonist looking on, and waiting for the sport to be renewed. When running, they are exceedingly animated, their little eyes glisten, and the orifices of their ears dilate and contract with rapidity; if taken into the hands at this time for examination, they struggle violently to escape, and their loose integuments render it difficult to retain them." They were found to sleep in various positions, mostly rolled up like a hedgehog into a ball, the tail being wrapped over the bill and head, sometimes in an extended attitude. Their periods of sleep and activity were very irregular, but the dusk of evening in most cases called forth all their energies. During the night they were generally active; night or evening we suspect to be the favourite period in which the ornithorhynchus seeks its food, wanders along the bank, constructs its burrow, and gambols with its mate.

Mr Bennet disproves by his personal experience the supposition that a wound inflicted by the spur of the animal is poisonous. "Having heard so much related about the injurious effects resulting from a puncture by the spur, I determined to avail myself of this opportunity (a wounded male had been taken out of the water), to ascertain the correctness of the assertion. The wounded state of the animal presented no objection to the experiment, as in one published account, in which the poison is reported to have produced such terrible effects, the animal was also mortally wounded. I commenced by placing my hands in such a manner, when seizing the animal, as to enable it, from the direction of the spurs, to use them with effect; the result was that the ness. These serve to excite and put his nobler passions into motion. He attacks them in their retreat, faces them with resolution, and seldom fails of coming off with a victory. He thus becomes hardier and better in the struggle, and learns to know and to value his own superiority.

As the last mentioned animals are called forth by his boldest efforts, so the numerous tribe of the smaller vermin kind excite his continual vigilance and caution; his various arts and powers have been nowhere more manifest, than in the extirpation of those that multiply with such prodigious fecundity. Neither their agility nor their minuteness can secure them from his pursuits; and though they may infest, they are seldom found materially to injure him.

In this manner we see, that not only human want is supplied, but that human wit is sharpened, by the humbler partners of man in the creation. By this we see, that not only their benefits but their depredations are useful, and that it has wisely pleased Providence to place us like victors in a subdued country, where we have all the benefit of conquest, without being so secure as to run into the sloth and excesses of a certain and undisturbed possession. It appears, therefore, that those writers who are continually finding immediate benefit in every production, see but half way into the general system of nature. Experience must every hour inform us, that all animals are not formed for our use; but we may be equally well assured, that those conveniences which we want from their friendship, are well repaid by that vigilance which we procure from their enmity.

---

animal made strenuous efforts to escape, and in these efforts scratched my hands a little with the hind claws, and even with the spur also. But although seized so roughly, it neither darted the spur into my hand, nor did it even make an attempt so to do. . . I tried several other methods of effecting the object I had in view, but as all proved futile, I am convinced that some other use must be found for the spur than as an offensive weapon. I have had several subsequent opportunities of repeating the experiments upon animals not in a wounded state, and the results have been the same."

The *Echidna*, or Porcupine Ant-eater (*E. hystrix*), representing the second genus of Monotremata, and the only species known, is also a native of Australia. It possesses marsupial bones like the opossum, and the males, like those of the previous genus, are furnished with spurs. It is destitute of teeth, the tongue is long and filiform, the muzzle is elongated in the form of a beak, surrounded by horny lips, and the mouth is very small. The feet are short, strong, five-toed, armed with long, stout, curved claws. The body is thick set, and the skin, besides hair, is covered with numerous spines, like those of the porcupine and hedgehog. The animal is two or three times larger than the common hedgehog. It burrows in the ground in sandy places, in which it remains during the dry season, coming out from its concealment only during rains. Like the hedgehog it rolls itself up in a ball, and its food seems to consist chiefly of ants. It is supposed to be capable of supporting a long abstinence. Lieutenant Breton had an echidna which lived with him in Australia, and survived a part of the voyage to England. It was captured by him on the Blue mountains; the animal is now uncommon in New South Wales. Its strength he considered to exceed, in proportion to its size, that of any other quadruped. Previous to embarkation, Lieutenant Breton fed his echidna on ant-eggs (pupæ) and milk; when on board, its diet consisted of eggs chopped small, with liver and meal. It drank much water. In eating, the motion of the tongue was very curious, sometimes being used like that of the chameleon, and at others, swung like a mower's scythe, thus sweeping the food into the mouth; there seemed to be an adhesive substance on the tongue, with the aid of which the food was seized. This specimen died suddenly off cape Horn, but there is an impression that no serious difficulty exists to the introduction of the animal alive into this country.

THE GORILLA.

The interest excited in the natural history of the Gorilla, or Great Chimpanzee, while the latter pages of this work are passing through the press, by the publication of M. Du Chaillu's *Explorations and Adventures in Equatorial Africa*, will justify the occupation of a spare corner, by a brief notice of that formidable species of the simial tribe. The *Troglodytes gorilla* has long been known to naturalists, although it was not till the year 1848 that Professor Owen gave to the world a correct description of the animal, specimens of the skeleton of which had been obtained from the Gaboon river, and which much exceeded in size, and was found to be specifically distinct from the previously known *T. niger*, the Chimpanzee, or Black Orang, known in its young state also by the name of Jocko. Fresh specimens of the gorilla having been brought to this country by M. Du Chaillu, Professor Owen has been able to determine still more satisfactorily the distinctive characters of this huge man-like ape. M. Du Chaillu's account of the habits of the animal has been subjected to considerable freedom of criticism, and the accuracy of his observations has been discredited by several naturalists; but his descriptions can hardly fail to interest the general reader. During his African researches he had long been in quest of the gorilla, and had endured many disappointments, when at length he made the acquaintance of the animal under the following circumstances:—"Suddenly," he says, "I was startled by a strange, discordant, half-human, devilish cry, and beheld four young gorillas running toward the deep forests. We fired, but hit nothing. Then we rushed on in pursuit, but they knew the woods better than we. Once I caught a glimpse of one of the animals again, but an intervening tree spoiled my mark, and I did not fire. We ran till we were exhausted, but in vain. The alert beasts made good their escape. I protest I felt almost like a murderer when I saw the gorillas this first time. As they ran on their hind legs, they looked fearfully like hairy men; their heads down, their bodies inclined forward—their whole appearance like men running for their lives. Take with this their awful cry, which, fierce and animal as it is, has yet something human in its discordance, and you will cease to wonder that the natives have the wildest superstitions about these 'wild men of the woods.'" A closer acquaintance speedily followed. The traveller thus describes the exciting incidents of that occasion: "The underbrush swayed rapidly just ahead, and presently before us stood an immense male gorilla. He had gone through the jungle on his all-fours, but when he saw our party, he erected himself, and looked us boldly in the face. He stood about a dozen yards from us, and was a sight I think I shall never forget. Nearly six feet high (he proved four inches shorter), with immense body, huge chest, and great muscular arms, with fiercely glaring large deep gray eyes, and a hellish expression of face, which seemed to me like some nightmare vision; thus stood before us this king of the African forest. He was not afraid of us. He stood there, and beat his breast with his huge fists, till it resounded like an immense bass-drum, which is their mode of offering defiance, meantime giving vent to roar after roar. The roar of the gorilla is the most singular and awful noise heard in these African woods. It begins with a sharp *bark*, like an angry dog, then glides into a deep bass *roll*, which literally and closely resembles the roll of distant thunder along the sky, for which I have sometimes been tempted to take it where I did not see the animal. His eyes began to flash fiercer fire as we stood motionless on the defensive, and the crest of short hair which stands on his forehead began to twitch rapidly up and down, while his powerful fangs were shown as he again sent forth a thunderous roar. And now truly he reminded me of nothing but some hellish dream creature—a being of that hideous order, half-man, half-beast, which we find pictured by old artists in some representations of the infernal regions. He advanced a few steps, then stopped to utter that hideous roar again—advanced again, and finally stopped when at a distance of about six yards from us. And here, just as he began another of his roars, beating his breast in rage, we fired, and killed him. With a groan which had something terribly human in it, and yet was full of brutishness, he fell forward on his face. The body shook convulsively for a few minutes, the limbs moved about in a struggling way, and then all was quiet—death had done its work, and I had leisure to examine the huge body. It proved to be five feet eight inches high, and the muscular development of the arms and breasts showed what immense strength it had possessed." M. Du Chaillu also describes how one of the negroes of his escort was killed by a gorilla: "He said that he had met the gorilla suddenly, and face to face, and that it had not attempted to escape. It was, he said, a huge male, and seemed very savage. He said he took good aim, and fired when the beast was only about eight yards off. The ball merely wounded it in the side. It at once began beating its breasts, and with the greatest rage advanced upon him." The negro reloaded his gun, but the animal sprang upon him, dashed the gun out of his hands, and striking him with its immense paw, lacerated the abdomen, and laid bare the intestines. As the man sank bleeding to the ground, the monster seized the gun, and flattened the barrel between his jaws. When the party came upon the ground, the dying man was alone, the gorilla having fled.

GLASGOW: W. G. BLACKIE AND CO., PRINTERS, VILLAFIELD.

MAY 14 1897

OCT 21 1897

[illegible] 1925

WIDENER

JUL 26 2000

CANCELLED

WIDENER

SEP 10 2000

BOOK DUE